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A HISTORY
OF
THE EARTH
AND
ANIMATED NATURE.
BY
OLIVER GOLDSMITH.

VOL. II.



WITH NUMEROUS ADDITIONAL NOTES.

E. W. SAWYER
425 NORTH JUNE STREET
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A. MILLARTON & CO. LONDON, EDINBURGH & DUBLIN.

A HISTORY
OF THE
EARTH AND ANIMATED NATURE,

BY
OLIVER GOLDSMITH.

*With an Introductory View of the Animal Kingdom, Translated from the French of
Baron Cuvier,*

AND COPIOUS NOTES
EMBRACING ACCOUNTS OF NEW DISCOVERIES IN NATURAL HISTORY;

A LIFE OF THE AUTHOR,

BY WASHINGTON IRVING;

AND
A CAREFULLY PREPARED INDEX TO THE WHOLE WORK.

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A HISTORY OF
THE EARTH AND ANIMATED NATURE.

PART THIRD.
HISTORY OF ANIMATED NATURE.
BIRDS.

CONTENTS OF PART THIRD.

	Page
INTRODUCTORY BOOK, viz.:	
CHAP. I. Of Birds in general,	3
CHAP. II. Of the Generation, Nestling, and Incubation of Birds,	8
CHAP. III. Of the Division of Birds,	13
BOOK II. Of the Ostrich, Emu, Cassowary and Dodo,	15
BOOK III. Rapacious Birds,	28
BOOK IV. Birds of the Poultry kind,	54
BOOK V. Birds of the Pie kind,	77
BOOK VI. Birds of the Sparrow kind,	120
BOOK VII. Birds of the Crane kind,	164
BOOK VIII. Of Water-Fowl,	197

HISTORY OF ANIMATED NATURE

PART THIRD.—OF BIRDS.

BOOK I.

INTRODUCTORY.

CHAP. I.

OF BIRDS IN GENERAL.

WE are now come to a beautiful and loquacious race of animals, that embellish our forests, amuse our walks, and exclude solitude from our most shady retirements. From these man has nothing to fear; their pleasures, their desires, and even their animosities, only serve to enliven the general picture of nature, and give harmony to meditation.

No part of nature appears destitute of inhabitants. The woods, the waters, the depths of the earth, have their respective tenants; while the yielding air, and those tracts of seeming space where man never can ascend, are also passed through by multitudes of the most beautiful beings of the creation.

Every order and rank of animals seems fitted for its situation in life; but none more apparently than birds: they share, in common with the stronger race of quadrupeds, the vegetable spoils of the earth; are supplied with swiftness, to compensate for their want of force; and have a faculty of ascending into the air, to avoid that power which they cannot oppose.

The bird seems formed entirely for a life of escape; and every part of the anatomy of the animal seems calculated for swiftness. As it is designed to rise upon air, all its parts are proportionably light, and expand a large surface without solidity.

In a comparative view with man, their formation seems much ruder and more imperfect; and they are in general found incapable of the docility even of quadrupeds. Indeed, what great degree of sagacity can be expected in animals whose eyes are almost as large as their brain? However, though they fall below quadrupeds in the scale of nature, and are less imitative of human endowments; yet they hold the next rank, and far surpass fishes and insects, both in the structure of their bodies and in their sagacity.

As in mechanics the most curious instruments are generally the most complicated, so it is in anatomy. The body of man presents the greatest variety upon dissection; quadrupeds, less perfectly formed, discover their defects in the simplicity of their conformation; the mechanism of birds is still less complex; fishes are furnished with fewer organs still; whilst insects, more imperfect than all, seem to fill up the chasm that separates animal from vegetable nature. Of man, the most perfect animal, there are but three or four species; of quadrupeds, the kinds are more numerous; birds are more various still; fishes yet more; but insects afford so very great a variety, that they elude the search of the most inquisitive pursuer.

Quadrupeds, as was said, have some distant resemblance in their internal structure with man; but that of birds is entirely dissimilar. As they seem chiefly formed to inhabit the empty regions of air, all their parts are adapted to their destined situation. It will be proper, therefore, before I give a general history of birds, to enter into a slight detail of their anatomy and conformation.

As to their external parts, they seem surprisingly adapted for swiftness of motion. The shape of their body is sharp before, to pierce and make way through the air; it then rises by a gentle swelling to its bulk, and falls off in an expansive tail, that helps to keep it buoyant, while the fore-parts are cleaving the air by their sharpness. From this conformation, they have often been compared to a ship making its way through water; the trunk of the body answers to the hold, the head to the prow, the tail to the rudder, and the wings to the oars; from whence the poets have adopted the metaphor of *remigium alarum*, when they described the wavy motion of a bird in flight.

What we are called upon next to admire in the external formation of birds is the neat position of the feathers, lying all one way, answering at once the purposes of warmth, speed, and security. They mostly tend backward, and are laid over

one another in an exact and regular order, armed with warm and soft down next the body, and more strongly fortified, and curiously closed externally, to fence off the injuries of the weather. But, lest the feathers should spoil by their violent attrition against the air, or imbibe the moisture of the atmosphere, the animal is furnished with a gland behind, containing a proper quantity of oil, which can be pressed out by the bird's bill, and laid smoothly over every feather that wants to be dressed for the occasion. This gland is situated on the rump, and furnished with an opening or excretory duct; about which grows a small tuft of feathers somewhat like a painter's pencil. When, therefore, the feathers are shattered or rumpled, the bird, turning its head backwards, with the bill catches hold of the gland, and, pressing it, forces out the oily substance, with which it anoints the disjointed parts of the feathers; and drawing them out with great assiduity, recomposes and places them in due order; by which they unite more closely together. Such poultry, however, as live for the most part under cover, are not furnished with so large a stock of this fluid, as those birds that reside in the open air. The feathers of a hen, for instance, are pervious to every shower; on the contrary, swans, geese, ducks, and all such as Nature has directed to live upon the water, have their feathers dressed with oil from the very first day of their leaving the shell. Thus their stock of fluid is equal to the necessity of its consumption. Their very flesh contracts a flavour from it, which renders it in some so very rancid, as to make it utterly unfit for food; however, though it injures the flesh, it improves the feathers for all the domestic purposes to which they are usually converted.

Nor are the feathers with which birds are covered less an object of admiration. The shaft of every feather is made proportionably strong; but hollow below for strength and lightness, and above filled with a pith to feed the growth of the vane or beard that springs from the shaft of the feather on either side. All these feathers are placed generally according to their length and strength, so that the largest and strongest feathers in flight have the greatest share of duty. The vane or beard of the feather is formed with equal contrivance and care. It consists not of one continued membrane; because, if this were broken, it could not easily be repaired; but it is composed of many layers, each somewhat in itself resembling a feather, and lying against each other in close conjunction. Towards the shaft of the feather, these layers are broad, and of a semicircular form, to serve for strength, and for the closer grafting them one against the other when in action. Towards the outer part of the vane, these layers grow slender and taper, to be more light. On their under-side they are thin and smooth, but their upper outer-edge is parted into two hairy edges, each side having a different sort of hairs, broad at bottom, and slender and

bearded above. By this mechanism, the hooked beards of one layer always lie next the straight beards of the next, and by that means lock and hold each other.

The next object that comes under consideration, in contemplating an animal that flies, is the wing, the instrument by which this wonderful progression is performed. In such birds that fly, they are usually placed at that part of the body which serves to poise the whole, and support it in a fluid that at first seems so much lighter than itself. They answer to the fore-legs in quadrupeds, and at the extremity of this they have a certain finger-like appendix, which is usually called the *bastard-wing*. This instrument of flight is furnished with quills, which differ from the common feathers only in their size being larger, and also from their springing from the deeper part of the skin, their shafts lying almost close to the bone. The beards of these quills are broad on one side and more narrow on the other, both which contribute to the progressive motion of the bird, and the closeness of the wing. The manner in which most birds avail themselves of these, is first thus; they quit the earth with a bound, in order to have room for flapping with the wing; when they have room for this, they strike the body of air beneath the wing with a violent motion, and with the whole under surface of the same; but then to avoid striking the air with equal violence on the upper side as they rise, the wing is instantly contracted; so that the animal rises by the impulse, till it spreads the wing for a second blow. For this reason we always see birds choose to rise against the wind, because they have thus a greater body of air on the under than the upper side of the wing. For these reasons also large fowls do not rise easily; both because they have not sufficient room at first for the motion of their wings, and because the body of air does not lie so directly under the wing as they rise.

In order to move the wings, all birds are furnished with two very strong pectoral muscles, which lie on each side of the breast-bone. The pectoral muscles of quadrupeds are trifling in comparison to those of birds. In quadrupeds, as well as in man, the muscles which move the thighs and hinder parts of the body are by far the strongest, while those of the arms are feeble; but in birds, which make use of their wings, the contrary obtains; the pectoral muscles, that move the wings or arms, are of enormous strength, while those of the thighs are weak and slender. By means of these, a bird can move its wings with a degree of strength, which, when compared to the animal's size, is almost incredible. The flap of a swan's wing would break a man's leg; and a similar blow from an eagle has been known to lay a man dead in an instant. Such, consequently, is the force of the wing, and such its lightness, as to be inimitable by art. No machines, that human skill can contrive, are capa-

ble of giving such force to so light an apparatus. The art of flying, therefore, that has so often and so fruitlessly been sought after, must, it is feared, for ever be unattainable; since as man increases the force of his flying machine, he must be obliged to increase its weight also.¹

¹ The following interesting sketch of the power exerted by birds in their flight, and the demonstration of man's incapability of flying, is from the chapter on Motion, in Carpenter's 'Animal Physiology'.

"The degree in which the wings act in raising the body or in propelling it through the air, varies considerably in different animals, according to the way in which they are set. Thus, in birds of prey, which require a rapid horizontal motion, the surface of the wings is very oblique, so that they strike backwards as well as downwards, and thus impel the body forwards whilst sustaining it in the air. Such birds find a difficulty in rising perpendicularly; and can in fact only do so by flying against the wind, which then acts upon the inclined surface of the wings just as it does upon that of a kite. On the other hand the lark, quail, and such other birds as rise to great heights in a direction nearly vertical, have the wings so disposed as to strike almost directly downwards. It has been estimated that a swallow, when simply sustaining itself in the air, is obliged to use as much force to prevent its fall as would raise its own weight to a height of about twenty-six feet in a second. Hence we may form some idea of the enormous expenditure of force which must take place when the body is not only supported but raised and propelled through the air. The eider-duck is said to fly ninety miles in an hour, and the hawk one hundred and fifty. The swallow and swift pass nearly the whole of the long summer days upon the wing, in search of food for themselves and their helpless offspring; and the rapidity of their flight is such that they can scarcely traverse less than seven or eight hundred miles in that time, although they go but a short distance from home. The flight of insects is even more remarkable for its velocity in proportion to their size; thus a swallow, which is one of the swiftest-flying of the birds, has been seen to chase a dragon-fly for some time without success; the insect always keeping about six feet in advance of the bird, and turning to one side and the other so instantaneously, that the swallow, with all its powers of sight and tact in chasing insects was unable to capture it. If the preceding estimate of the power expended by a bird in sustaining itself in the air be correct, it may be easily proved that it would be impossible for a man to sustain himself in the air, by means of his muscular strength alone, in any manner that he is capable of applying it. It is calculated that a man of ordinary strength can raise 134 pounds to a height of 3½ feet per second, and can continue this exertion for eight hours in the day. He will then exert a force capable of raising 381,600 pounds to a height of 3½ feet; or one-eighth that amount, namely, 47,700 pounds, to the height of 26 feet,—which, as we have seen, is that to which a bird would raise itself in one second by the force it is obliged to exert in order to sustain itself in the air. Now if we suppose it possible that a man could by any means concentrate the whole muscular power required for such a day's labour into as short a period as the accomplishment of this object requires, we might find the time during which it would support him in the air, by simply dividing this amount by his weight, which we may take to be 150 pounds. The quotient is 318, which is the number of seconds during which the expenditure of a force that would raise 47,700 pounds to a height of 26 feet will keep his body supported in the air; and this is but little more than

In all birds, except nocturnal ones, the head is smaller, and bears less proportion to the body than in quadrupeds, that it may more readily divide the air in flying, and make way for the body, so as to render its passage more easy. Their eyes also are more flat and depressed than in quadrupeds; a circle of small plates of bone, placed scalewise, under the outer coat of the organ, encompasses the pupil on each, to strengthen and defend it from injuries. Besides this, birds have a kind of skin, called the nictitating membrane, with which, like a veil, they can at pleasure cover their eyes, though their eye-lids continue open. This membrane takes its rise from the greater or more obtuse corner of the eye, and serves to wipe, cleanse, and probably to moisten its surface. The eyes, though they outwardly appear but small, yet separately, each almost equals the brain; whereas in man the brain is more than twenty times larger than the orbit of the eye. Nor is this organ in birds less adapted for vision by a particular expansion of the optic nerve, which renders the impressions of external objects more vivid and distinct.

From this conformation of the eye it follows, that the sense of seeing in birds is infinitely superior to that of other animals. Indeed this piercing sight seems necessary to the creature's support and safety. Were this organ blunter, from the rapidity of the bird's motion, it would be apt to strike against every object in its way; and it could scarcely find subsistence unless possessed of a power to discern its food from above with astonishing sagacity. A hawk, for instance, perceives a lark at a distance which neither men nor dogs could spy; a kite, from an almost imperceptible height in the clouds, darts down on its prey with the most unerring aim. The sight of birds, therefore, exceeds what we know in most other animals, and excels them both in strength and precision.

All birds want the external ear standing out from the head; they are only furnished with holes that convey sounds to the auditory canal. It is true, indeed, that the horned owl, and one or two more birds, seem to have external ears; but what bears that resemblance are only feathers sticking out on each side of the head, but no way necessary to the sense of hearing. It is probable, however, that the feathers encompassing the ear-holes in birds supply the defect of the exterior ear, and collect sounds to be transmitted to the

five minutes. There is no possible means, however, by which a man could thus concentrate the force of eight hours' labour into the short interval in which he would have to expend it when supporting himself in the air. And we have elsewhere seen that by no combination of mechanical powers can force be created; as these only enable force to be more advantageously applied. Hence the problem of human flight will never be solved until some source of power shall be discovered far surpassing that which his muscular strength affords, and so portable in its nature as not materially to add to his weight."—En

internal sensory. The extreme delicacy of this organ is easily proved by the readiness with which birds learn tunes, or repeat words, and the great exactness of their pronunciation.

The sense of smelling seems not less vivid in the generality of birds. Many of them *wind* their prey at an immense distance, while others are equally protected by this sense against their insidious pursuers. In decoys where ducks are caught, the men who attend them universally keep a piece of turf burning near their mouths, upon which they breathe, lest the fowl should smell them, and consequently fly away. The universality of this practice puts the necessity of it beyond a doubt, and proves the extreme delicacy of the sense of smelling, at least in this species of the feathered creation.

Next to the parts for flight, let us view the legs and feet ministering to motion. They are both made light, for the easier transportation through the air. The toes in some are webbed to fit them for the waters; in others they are separate, for the better holding objects, or clinging to trees for safety. Such as have long legs have also long necks, as otherwise they would be incapable of gathering up their food either by land or water. But it does not hold, however, that those who have long necks should have long legs, since we see that swans and geese, whose necks are extremely long, have very short legs, and these chiefly employed in swimming.

Thus every external part, hitherto noticed, appears adapted to the life and situation of the animal; nor are the inward parts, though less immediately appropriated to flight, less necessary to safety. The bones of every part of the body are extremely light and thin; and all the muscles, except that immediately moving the wings, extremely slight and feeble. The tail, which is composed of quill feathers, serves to counter-balance the head and neck; it guides the animal's flight like a rudder, and greatly assists it either in its ascent or when descending.

If we go on to examine birds internally, we shall find the same wonderful conformation fitting them for a life in air, and increasing the surface by diminishing the solidity. In the first place, their lungs, which are commonly called the *sole*, stick fast to the sides of the ribs and back, and can be very little dilated or contracted. But to make up for this, which might impede their breathing, the ends of the branches of the windpipe open into them, while these have openings into the cavity of the belly, and convey the air drawn in by breathing into certain receptacles like bladders, running along the length of the whole body. Nor are these openings obscure, or difficult to be discerned; for a probe thrust into the lungs of a fowl will easily find a passage into the belly; and air blown into the windpipe will be seen to distend the animal's body like a bladder. In quadrupeds this passage is stopped by the midriff; but in fowls the communication

is obvious; and consequently, they have a much greater facility of taking a long and large inspiration. It is sometimes also seen that the windpipe makes many convolutions within the body of a bird, and it is then called the *labyrinth*; but of what use these convolutions are, or why the windpipe should make so many turnings within the body of some birds, is a difficulty for which no naturalist has been able to account.

This difference of the windpipe often obtains in animals that, to all appearance, are of the same species. Thus in the tame swan, the windpipe makes but a straight passage into the lungs; while in the wild swan, which to all external appearance seems the same animal, the windpipe pierces through the breast-bone, and there has several turnings before it comes out again, and goes to enter the lungs. It is not to form the voice that these turnings are found, since the fowls that are without them are vocal; and those, particularly the bird just now mentioned, that have them, are silent. Whence, therefore, some birds derive that loud and various modulation in their warblings, is not easily to be accounted for; at least the knife of the anatomist goes but a short way in the investigation. All we are certain of is, that birds have much louder voices, in respect to their bulk, than animals of any other kind; for the bellowing of an ox is not louder than the scream of a peacock.

In these particulars, birds pretty much resemble each other in their internal conformation; but there are some varieties which we should more attentively observe. All birds have, properly speaking, but one stomach; but this is very different in different kinds. In all the rapacious kinds that live upon animal food, as well as in some of the fish-feeding tribe, the stomach is peculiarly formed. The *oesophagus*, or gullet, in them, is found replete with glandulous bodies, which serve to dilate and macerate the food, as it passes into the stomach, which is always very large in proportion to the size of the bird, and generally wrapped round with fat, in order to increase its warmth and powers of digestion.

Granivorous birds, or such as live upon fruits, corn, and other vegetables, have their intestines differently formed from those of the rapacious kind. Their gullet dilates just above the breast-bone, and forms itself into a pouch or bag, called the crop. This is replete with salivary glands, which serve to moisten and soften the grain and other food which it contains. These glands are very numerous, with longitudinal openings, which emit a whitish and a viscous substance. After the dry food of the bird has been macerated for a convenient time, it then passes into the belly, where, instead of a soft moist stomach, as in the rapacious kinds, it is ground between two pair of muscles, commonly called the gizzard, covered on the inside with a stony ridgy coat, and almost cartilaginous. These coats rubbing

against each other, are capable of bruising and attenuating the hardest substances, their action being often compared to that of the grinding teeth in man and other animals. Thus the organs of digestion are in a manner reversed in birds. Beasts grind their food with their teeth, and then it passes into the stomach, where it is softened and digested. On the contrary, birds of this sort first macerate and soften it in the crop, and then it is ground and comminuted in the stomach or gizzard. Birds are also careful to pick up sand, gravel, and other hard substances, not to grind their food as has been supposed, but to prevent the too violent action of the coats of the stomach against each other.

Most birds have two appendices, or blind-guts, which, in quadrupeds, are always found single. Among such birds as are thus supplied, all carnivorous fowl, and all birds of the sparrow kind, have very small and short ones; water-fowl and birds of the poultry kind, the longest of all. There is still another appendix observable in the intestines of birds, resembling a little worm, which is nothing more than the remainder of that passage by which the yolk was conveyed into the guts of the young chicken, while yet in the egg and under incubation.

The outlet of that duct which conveys the bile into the intestines is, in most birds, a great way distant from the stomach; which may arise from the danger there would be of the bile regurgitating into the stomach in their various rapid motions, as we see in men at sea; wherefore their biliary duct is so contrived, that this regurgitation cannot take place.

All birds, though they want a bladder for urine, have large kidneys and ureters, by which this secretion is made, and carried away by one common canal. "Birds," says Harvey, "as well as serpents, which have spongy lungs, make but little water, because they drink but little. They therefore have no need of a bladder; but their urine distils down into the common canal, designed for receiving the other excrements of the body. The urine of birds differs from that of other animals: for, as there is usually in urine two parts, one more serous and liquid, the other more thick and gross, which subsides to the bottom; in birds, the last part is most abundant, and is distinguished from the rest by its white or silver colour. This part is found not only in the whole intestinal canal, but is seen also in the whole channel of the ureters, which may be distinguished from the coats of the kidneys by their whiteness. This milky substance they have in greater plenty than the more thin and serous part; and it is of a middle consistence, between limpid urine and the grosser parts of the fæces. In passing through the ureters it resembles milk curdled or lightly condensed: and being cast forth, easily congeals into a chalky crust."

From this simple conformation of the animal, it should seem that birds are subject to few

diseases; and in fact, they have but few. There is one, however, which they are subject to, from which quadrupeds are in a great measure exempt; this is the annual moulting which they suffer; for all birds whatsoever obtain a new covering of feathers once a-year, and cast the old. During the moulting season, they ever appear disordered; those most remarkable for their courage, then lose all their fierceness; and such as are of a weakly constitution, often expire under this natural operation. No feeding can maintain their strength; they all cease to breed at this season; that nourishment which goes to the production of the young is wholly absorbed by the demand required for supplying the nascent plumage.

This moulting time, however, may be artificially accelerated; and those who have the management of singing birds frequently put their secret in practice. They enclose the bird in a dark cage, where they keep it excessively warm, and throw the poor little animal into an artificial fever; this produces the moult; his old feathers fall before their time, and a new set take place, more brilliant and beautiful than the former. They add, that it mends the bird's singing, and increases its vivacity; but it must not be concealed, that scarcely one bird in three survives the operation.

The manner in which nature performs this operation of moulting is thus: the quill, or feather, when first protruded from the skin, and come to its full size, grows harder as it grows older, and receives a kind of periosteum or skin round the shaft, by which it seems attached to the animal. In proportion as the quill grows older, its sides, or the bony part, thicken; but its whole diameter shrinks and decreases. Thus, by the thickening of its sides, all nourishment from the body becomes more sparing; and, by the decrease of its diameter, it becomes more loosely fixed in its socket, till at length it falls out. In the meantime the rudiments of an incipient quill are beginning below. The skin forms itself into a little bag, which is fed from the body by a small vein and artery, and which every day increases in size till it is protruded. While the one end vegetates into the beard or vane of the feather, that part attached to the skin is still soft, and receives a constant supply of nourishment, which is diffused through the body of the quill by that little light substance which we always find within when we make a pen. This substance, which as yet has received no name that I know of, serves the growing quill as the umbilical artery does an infant in the womb, by supplying it with nourishment, and diffusing that nourishment over the whole frame. When, however, the quill is come to its full growth, and requires no further nourishment, the vein and artery become less and less, till at last the little opening by which they communicated with the quill becomes wholly obliterated; and the quill,

thus deprived, continues in its socket for some months, till in the end it shrinks, and leaves room for a repetition of the same process of nature as before.

The moulting season commonly obtains from the end of summer to the middle of autumn. The bird continues to struggle with this malady during winter; and nature has kindly provided, that when there are the fewest provisions, that then the animal's appetite should be least craving. At the beginning of spring, when food begins again to be plentiful, the animal's strength and vigour return. It is then that the abundance of provisions, aided by the mildness of the season, incite it to love, and all nature seems teeming with life, and disposed to continue it.

CHAP. II.

OF THE GENERATION, NESTLING, AND INCUBATION OF BIRDS.

THE return of spring is the beginning of pleasure. Those vital spirits, which seem locked up during the winter, then begin to expand; vegetables and insects supply abundance of food; and the bird having more than a sufficiency for its own subsistence, is impelled to transfuse life, as well as to maintain it. Those warblings, which had been hushed during the colder seasons, now begin to animate the fields; every grove and bush resounds with the challenge of anger, or the call of allurements. This delightful concert of the grove, which is so much admired by man, is no way studied for his amusement; it is usually the call of the male to the female, his efforts to soothe her during the time of incubation; or it is a challenge between two males, for the affections of some common favourite.

It is by this call that birds begin to pair at the approach of spring, and provide for the support of a future progeny. The loudest notes are usually from the male, while the hen seldom expresses her consent but in a short interrupted twittering. This compact, at least for the season, holds with unbroken faith; many birds live with inviolable fidelity together for a constancy; and when one dies, the other is always seen to share the same fate soon after. We must not take our idea of the conjugal fidelity of birds from observing the poultry in our yards, whose freedom is abridged, and whose manners are totally corrupted by slavery. We must look for it in our fields and our forests, where nature continues in unadulterated simplicity; where the number of males is generally equal to that of females; and where every little animal seems prouder of his progeny than pleased with his mate. Were it possible to compare sensations, the male of all wild birds seems as happy in the young brood as the female; and all his former

caresses, all his soothing melodies, seem only aimed at that important occasion, when they are both to become parents, and to educate a progeny of their own producing. The pleasures of love appear dull in their effects, when compared to the interval immediately after the exclusion of their young. They both seem at that season transported with pleasure; every action testifies their pride, their importance, and tender solicitude.

When the business of fecundation is performed, the female then begins to lay. Such eggs as have been impregnated by the cock are prolific; and such as have not, for she lays often without any congress whatsoever, continue barren, and are only addled by incubation. Previous, however, to laying, the work of nestling becomes the common care; and this is performed with no small assiduity and apparent design. It has been asserted that birds of one kind always make their nests in the same manner, and of the same materials; but the truth is, that they vary this as the materials, places, or climates, happen to differ. The redbreast in some parts of England makes its nest with oak-leaves, where they are in greatest plenty; in other parts with moss and hair. Some birds, that with us make a very warm nest, are less solicitous in the tropical climates, where the heat of the weather promotes the business of incubation. In general, however, every species of birds has a peculiar architecture of its own; and this adapted to the number of eggs, the temperature of the climate, or the respective heat of the little animal's own body. Where the eggs are numerous, it is then incumbent to make the nest warm, that the animal heat may be equally diffused to them all. Thus the wren, and all the small birds, make the nest very warm; for having many eggs, it is requisite to distribute warmth to them in common: on the contrary, the plover, that has but two eggs, the eagle, and the crow, are not so solicitous in this respect, as their bodies are capable of being applied to the small number upon which they sit. With regard to climate, water-fow¹, that with us make but a very slovenly nest, are much more exact in this particular in the colder regions of the north. They there take every precaution to make it warm; and some kinds strip the down from their breasts, to line it with greater security.¹

¹ "The construction and selected situations of the nests of birds, are as remarkable as the variety of materials employed in them; the same forms, places, and articles, being rarely, perhaps never, found united by the different species, which we should suppose similar necessities would direct to a uniform provision. Birds that build early in the spring seem to require warmth and shelter for their young; and the blackbird and the thrush line their nests with a plaster of loam, perfectly excluding, by these cottage-like walls, the keen icy gales of our opening year; yet should accident bereave the parents of their first hopes, they will construct another, even when summer is far advanced, upon the model of their first

In general, however, every bird resorts to hatch in those climates and places where its food is found in greatest plenty; and always at that season when provisions are in the greatest abundance.

erection, and with the same precautions against severe weather, when all necessity for such provision has ceased, and the usual temperature of the season rather requires coolness and a free circulation of air. The house sparrow will commonly build four or five times in the year, and in a variety of situations, under the warm eaves of our houses and our sheds, the branch of the clustered fir, or the thick tall hedge that bounds our garden, &c.; in all which places, and without the least consideration of site or season, it will collect a great mass of straw and hay, and gather a profusion of feathers from the poultry-yard to line its nest. This cradle for its young, whether under our tiles in March or in July, when the parent-bird is panting in the common heat of the atmosphere, has the same provisions made to afford warmth to the brood; yet this is a bird that is little affected by any of the extremes of our climate. The wood pigeon and the jay, though they erect their fabrics on the tall underwood in the open air, will construct them so slightly, and with such a scanty provision of materials, that they seem scarcely adequate to support their broods, and even their eggs may almost be seen through the loosely connected materials: but the goldfinch, that inimitable spinner, the Arachne of the grove, forms its cradle of fine mosses and lichens, collected from the apple or the pear-tree, compact as a felt, lining it with the down of thistles besides, till it is as warm as any texture of the kind can be, and it becomes a model for beautiful construction. The golden-crested wren, a minute creature perfectly unmindful of any severity in our winter, and which hatches its young in June, the warmer portion of our year, yet builds its most beautiful nest with the utmost attention to warmth; and in weaving small branches of moss with the web of the spider, forms a closely-compacted texture nearly an inch in thickness, lining it with such a profusion of feathers, that, sinking deep into this downy accumulation, it seems almost lost itself when sitting, and the young, when hatched, appear stifled with the warmth of their bedding, and the heat of their apartment; while the white-throat, the black-cap, and others, which will hatch their young nearly at the same period, or in July, require nothing of the kind. A few loose bents and goose-grass, rudely entwined, with perhaps the luxury of some scattered hairs, are perfectly sufficient for all the wants of these; yet they are birds that live only in genial temperatures, feel nothing of the icy gales that are natural to our pretty indigenous artists, but flit from sun to sun, and we might suppose would require much warmth in our climate during the season of incubation; but it is not so. The greenfinch places its nest in the hedge with little regard to concealment; its fabric is slovenly and rude, and the materials of the coarsest kinds; while the chaffinch, just above it in the elm, hides its nest with cautious care, and moulds it with the utmost attention to order, neatness, and form. One bird must have a hole in the ground; to another a crevice in the wall, or a chink in a tree is indispensable. The bullfinch requires fine roots for its nest; the gray fly-catcher will have cobwebs for the outworks of its shed. All the parus tribe, except the individual above-mentioned, select some hollow in a tree, or cranny in a wall; and sheltered as such places must be, yet will they collect abundance of feathers and warm materials for their infants' bed. Endless examples might be found of the dissimilarity of requirements in these constructions among the several associates

dance. The large birds, and those of the aquatic kinds, choose places as remote from man as possible, as their food is in general different from that which is cultivated by human labour. Some birds which have only the serpent to fear, build their nests depending from the end of a small bough, and form the entrance from below; being thus secured either from the serpent or the monkey tribes. But all the little birds which live upon fruits and corn, and that are too often unwelcome intruders upon the fruits of human industry, in making their nests, use every precaution to conceal them from man. On the other hand, the great birds remote from human society, use every precaution to render theirs inaccessible to wild beasts or vermin.

Nothing can exceed the patience of birds while hatching; neither the calls of hunger, nor the near approach of danger, can drive them from the nest. They are often fat upon beginning to sit, yet before incubation is over, the female is usually wasted to skin and bone. Ravens and crows, while the females are sitting, take care to provide them with food; and this in great abundance. But it is different with most of the smaller kinds: during the whole time, the male sits near his mate upon some tree, and soothes her by his singing; and often when she is tired takes her place, and patiently continues upon the nest till she returns. Sometimes, however, the eggs acquire a degree of heat too much for the purposes of hatching; in such cases, the hen leaves them to cool a little, and then returns to sit with her usual perseverance and pleasure.

So great is the power of instinct, in animals of this class, that they seem driven from one appetite to another, and continue almost passive under its influence. Reason we cannot call it, since the first dictates of that principle would be self-preservation. "Take a brute," says Addison, "out of his instinct, and you find him wholly deprived of understanding. With what caution," continues he, "does the hen provide herself with a nest in places unfrequented, and free from noise and disturbance! When she has laid her eggs in such a manner that she can cover them, what care does she take in turning them frequently, that all parts may partake of the vital warmth! When she leaves them, to provide for her necessary sustenance, how punctually does she return before they have time to cool, and become incapable of producing an animal! In the summer you see her giving herself greater freedoms, and quitting her care for above two

of our groves, our hedges, and our houses; and yet the supposition cannot be entertained for a moment that they are superfluous, or not essential for some purpose with which we are unacquainted. By how many of the ordinations of Supreme Intelligence is our ignorance made manifest! Even the fabrication of the nests of these little animals exceeds our comprehension; we know none of the causes or motives of that unembodied mind that willed them thus."—*Journal of a Naturalist*

hours together; but in winter, when the rigour of the season would chill the principles of life, and destroy the young one, she grows more assiduous in her attendance, and stays away but half the time. When the birth approaches, with how much nicety and attention does she help the chick to break the prison! not to take notice of her covering it from the injuries of the weather, providing it with proper nourishment, and teaching it to help itself; nor to mention her forsaking the nest, if, after the usual time of reckoning, the young one does not make its appearance. A chemical operation could not be followed with greater art or diligence than is seen in the hatching a chick, though there are many birds that show an infinitely greater sagacity: yet at the same time the hen, that has all this seeming ingenuity, (which is indeed absolutely necessary for the propagation of the species,) considered in other respects, is without the least glimmerings of thought or common sense: she mistakes a piece of chalk for an egg, and sits upon it in the same manner; she is insensible of any increase or diminution in the number of those she lays; she does not distinguish between her own and those of another species; and when the birth appears of never so different a bird, will cherish it for her own. A hen followed by a brood of ducks, shall stand affrighted at the edge of the pond, trembling for the fate of her young, which she sees venturing into so dangerous an element. As the different principle which acts in these different animals cannot be termed reason, so when we call it instinct, we mean something we have no knowledge of. It appears to me the immediate direction of Providence; and such an operation of the Supreme Being, as that which determines all the portions of matter to their proper centres."

The production of the young, as was said, seems to be the great era of a bird's happiness. Nothing can at that time exceed its spirit and industry: the most timid becomes courageous in the defence of its young. Birds of the rapacious kind, at this season, become more than usually fierce and active. They carry their prey, yet throbbing with life, to the nest, and early accustom their young to habits of slaughter and cruelty. Nor are those of milder natures less busily employed; the little birds then discontinue their singing, taken up with more important pursuits of common subsistence.

While the young are yet unfledged and continue in the nest, the old ones take care to provide them with a regular supply; and, lest one should take all nourishment from the rest, they feed each of the young in their turn. If they perceive that man has been busy with their nest, or has handled the little ones, they abandon the place by night, and provide their brood a more secure, though less commodious, retreat. When the whole family is completely plumed, and capable of avoiding danger by flight, they are then

led forth when the weather is fine, and taught the paternal art of providing for their subsistence. They are led to the places where their food lies; they are shown the method of discovering or carrying it away; and then led back to the nest, for a day or two longer. At length, when they are completely qualified to shift for themselves, the old ones take them abroad, and leading them to the accustomed places, forsake them for the last time; and all future connexion is ever at an end.

Those birds which are hatched and sent out earliest in the season, are the most strong and vigorous; those, on the other hand, that have been delayed till the midst of summer, are more feeble and tender, and sometimes incapable of sustaining the rigours of the ensuing winter. Birds themselves seem sensible of this difference, and endeavour to produce early in the spring. If, however, their efforts are obstructed by having their nests robbed, or some similar accident, they still persevere in their efforts for a progeny; and it often happens that some are thus retarded till the midst of winter. What number of eggs any bird can lay in the course of a season, is not ascertained; but this is true, that such as would have laid but two or three at the most, if their nests be robbed, or their eggs stolen, will lay above ten or twelve. A common hen, if moderately fed, will lay above a hundred from the beginning of spring to the latter end of autumn. In general, however, it obtains, that the smallest and weakest animals are the most prolific, while the strong and rapacious are abridged by sterility. Thus, such kinds as are easily destroyed, are as readily repaired; and nature, where she has denied the power of resistance, has compensated by the fertility attending procreation.

Birds in general, though they have so much to fear from man and each other, are seldom scared away from their usual haunts. Although they be so perfectly formed for a wandering life, and are supplied with powers to satisfy all their appetites, though never so remote from the object, though they are so well fitted for changing place with ease and rapidity, yet the greatest number remain contented in the districts where they have been bred, and by no means exert their desires in proportion to their endowments. The rook, if undisturbed, never desires to leave his native grove; the blackbird still frequents its accustomed hedge; and the redbreast, though seemingly mild, claims a certain district, from which he seldom moves, but drives out every one of the same species from thence without pity. They are excited to migration by no other motives but those of fear, climate, or hunger. It must be from one of these powerful motives that the birds, which are called birds of passage, every year forsake us for some time, and make their regular and expected returns.

Nothing has more employed the curiosity of mankind than these annual emigrations; and

yet few subjects continue so much involved in darkness. It is generally believed, that the cause of their retreat from these parts of Europe, is either a scarcity of food at certain seasons, or the want of a secure asylum from the persecution of man, during the time of courtship, and bringing up their young. Thus the starling in Sweden, at the approach of winter, finding subsistence no longer in that kingdom, descends every year into Germany; and the hen-chaffinches of the same country are seen every year to fly through Holland in large flocks, to pass their winter in a milder climate. Others, with a more daring spirit, prepare for journeys that might intimidate even human perseverance. Thus the quails, in spring, forsake the burning heats of Africa for the milder sun of Europe; and, when they have passed the summer with us, steer their flight back to enjoy in Egypt the temperate air, which then begins to be delightful. This, with them, seems a preconcerted undertaking. They unite together in some open place, for some days before their departure, and, by an odd kind of chattering, seem to debate on the method to proceed. When their plan is resolved upon, they all take flight together, and often appear in such numbers, that to mariners at sea they seem like a cloud that rests upon the horizon. The boldest, strongest, and by far the greatest number, make good their intention; but many there are, who, not well apprized of their own force for the undertaking, grow weary on the way, and, quite spent by the fatigues of their flight, drop down into the sea, and sometimes upon deck, thus becoming an easy prey to the mariner.

Of the vast quantity of water-fowl that frequent our shores, it is amazing to reflect how few are known to breed here. The cause that principally urges them to leave this country, seems to be not merely the want of food, but the desire of a secure retreat. Our country is too populous for birds so shy and timid as the greatest number of these are. When great part of our island was a mere waste, an uncultivated tract of woods and marshes, many species of birds which now migrate remained with us throughout the year. The great heron and the crane, that have now forsaken this country, in former times bred familiarly in our marshes, and seemed to animate our fens. Their nests, like those of most cloven-footed water-fowl, were built on the ground, and exposed to every invader. But as rural economy increased, these animals were more and more disturbed. Before they had little to fear, as the surrounding marsh defended them from all the carnivorous quadrupeds, and their own strength from birds of prey; but upon the intrusion of man, and by a long series of alarms, they have at length been obliged to seek, during the summer, some lonely habitation, at a safe distance from every destroyer.

Of the numerous tribes of the duck kind, we know of no more than five that breed here; the

tame swan, the tame goose, the sheldrake, the eider-duck, and a few of the wild ducks. The rest contribute to form that amazing multitude of water-fowl which annually repair to the dreary lakes and deserts of Lapland from the more southern countries of Europe. In those extensive and solitary retreats, they perform the duties of incubation and nutrition in full security. There are few of this kind that may not be traced to the northern deserts, to countries of lakes, rivers, swamps, and mountains, covered with thick and gloomy forests, that afford shelter during summer to the timid animals, who live there in undisturbed security. In those regions, from the thickness of the forests, the ground remains moist and penetrable during the summer season; the woodcock, the snipe, and other slender-billed birds, can there feed at ease; while the web-footed birds find more than sufficient plenty of food from the number of insects, which swarm there to an incredible degree. The days there are long; and the beautiful meteorous nights afford them every opportunity of collecting so minute a food, which is probably, of all others, the most grateful. We are not to be astonished, therefore, at the amazing numbers of fowl that descend from these regions at the approach of winter; numbers to which the army of Xerxes was but trifling in comparison; and which Linnæus has observed for eight whole days and nights to cover the surface of the river Calix.

This migration from the north usually begins in September, when they quit their retreats, and disperse themselves over all the southern parts of Europe. It is not displeasing to observe the order of their flight; they generally range themselves in a long line, or they sometimes make their march angularly, two lines uniting in the centre like the letter V reversed. The bird which leads at the point seems to cleave the air, to facilitate the passage for those which are to follow. When fatigued with this laborious station, it falls back into one of the wings of the file, while another takes its place. With us they make their appearance about the beginning of October, circulate first round our shores, and, when compelled by severe frost, betake themselves to our lakes and rivers. Some, indeed, of the web-footed fowl, of hardier constitutions than the rest, abide the rigours of their northern climate the whole winter; but when the cold reigns there with more than usual severity, they are obliged to seek for more southern skies. They then repair with the rest for shelter to these kingdoms; so that the diver, the wild swan, and the swallow-tailed sheldrake, visit our coasts but seldom, and that only when compelled by the severity of their winters at home.

It has often been a subject of astonishment, how animals to all appearance so dull and irrational should perform such long journeys, should know whither to steer, and when to set out upon such a great undertaking. It is probable that

the same instinct which governs all their other actions operates also here. They rather follow the weather than the country; they steer only from colder or warmer climates into those of an opposite nature; and finding the variations of the air as they proceed in their favour, go on till they find land to repose on. It cannot be supposed that they have any memory of the country where they might have spent a former winter; it cannot be supposed that they see the country to which they travel, from their height in the air; since, though they mounted for miles, the convexity of the globe would intercept their view: it must therefore only be, that they go on as they continue to perceive the atmosphere more suitable to their present wants and dispositions.²

All this seems to be pretty plain; but there is a circumstance attending the migration of swallows which wraps this subject in great obscurity. It is agreed on all hands, that they are seen migrating into warmer climates, and that in amazing numbers, at the approach of the European winter. Their return into Europe is also as well attested about the beginning of summer; but we have another account, which serves to prove that numbers of them continue torpid here during the winter, and, like bats, make their retreat into old walls, the hollow of trees, or even sink into the deepest lakes, and find security for the winter season by remaining there in clusters at the bottom. However this latter circumstance may be, their retreat into old walls is too well authenticated to remain a doubt at present. The difficulty, therefore, is to account for this difference in these animals thus variously preparing to encounter the winter. It was supposed that in some of them the blood might lose its motion by the cold, and that thus they were rendered torpid by the severity of the season; but Mr. Buffon having placed many of this tribe in an ice-house, found that the same cold by which their blood was congealed was fatal to the animal; it remains, therefore, a doubt to this hour, whether there may not be a species of swallows to all external appearance like the rest, but differently formed within, so as to fit them for a state of insensibility during the winter here. It was suggested, indeed, that the swallows found thus torpid, were such only as were too weak to undertake the migration, or were hatched too late to join the general convoy; but it was upon these that Mr. Buffon tried his experiment; it was these that died under the operation.³

² By attaching a silken thread to their leg, it has been well ascertained that swallows return to their former haunts.—Ed.

³ The analogy between birds of passage, and animals which remain in a state of torpidity during the winter, does not appear to be accurately drawn by our author: the following are the objections to the supposed constitutional connexion. Those quadrupeds, reptiles, and insects, which pass the winter in

Thus there are some birds which, by migrating, make an habitation of every part of the earth; but in general every climate has birds peculiar to itself. The feathered inhabitants of the tem-

a state of insensibility, may be recalled to sensation and action at pleasure, by the application of a gentle degree of warmth. Philosophers have been induced, from this constitutional singularity of these animals, to conclude unanimously, that the return of spring rouses them from their lethargic state, to enjoy the benefits of the season. And what in some measure seems to give stability to this supposition is, that the animals in question take up their abodes a little below the surface of the soil; some in the crevices of walls, or interstices of rocks; and others, such as frogs, female toads, and water-newts, bury themselves in the mud of shallow ponds. In the former of these retreats they are only covered by a thin layer of earth; and in the latter, by the addition of a shallow sheet of water; consequently they are reanimated in due season, by the genial rays of the sun, after he has entered the northern half of the ecliptic. Dr. Hales has proved by experimental facts, that the bulb of a thermometer buried 16 inches below the earth's surface, stood at 25° of his scale in September, at 16° in October, and at 10° in November, during a severe frost; from which point it ascended again slowly, and reached 23° in the beginning of April (old style). Now the end of September, and beginning of October, is the season the hedgehog, shrew, bat, toad, and frog disappear: and about the middle of April these animals reappear; which agrees very well with the variations of temperature of the preceding theory. The migratory birds of this country are very numerous; how comes it then that they are never found near the surface of the earth, as is the bat, hedgehog, &c.? A few solitary facts of birds being found in holes, in old walls, and in the earth, are on record; but this is by no means a sufficient reason for establishing a theory of their remaining in a state of torpidity during the winter. The temperature of places situated at great depths below the surface of the land and water, is sufficient objection to the circumstance of birds remaining in a torpid state, during the winter, in solitary caverns, or at the bottom of deep lakes. It is a known fact, that all places situated 80 feet below the surface of the earth are constantly of the same temperature. Mr. Boyle kept a thermometer for a year under a roof of 80 feet in thickness, and found that the liquor in the instrument remained stationary all the time. Dr. Withering made a similar experiment on a well 84 feet deep, and found it remained at 49° for the year round. Surely this invariable temperature is inconsistent with the theory of birds remaining in a state of torpidity in deep lakes, or solitary caverns, where the sun has no influence; for what would call forth their dormant organs into action? the vernal sun having no influence on places so situated. It is but reasonable to conclude, that cold which kept them benumbed by its sleepy torpor, would evidently perpetuate their slumbers. This state of torpor is obviously analogous to sleep; but it differs from sleep in being occasioned solely by temperature.—Hibernating animals always assume this torpid state, whenever the thermometer sinks to a certain point. Almost all animals seem to be susceptible of this state, at least to a certain extent, not even excepting man. For the apparent death produced by cold is probably nothing else but a species of torpor, out of which the animal, in most cases, might be roused, if the requisite caution in applying the heat were attended to; for death, in most cases, seems to be produced not by the cold, but by the incautious application of heat, which bursts the vessels and destroys the

perate zone are but little remarkable for the beauty of their plumage; but then the smaller kinds make up for this defect by the melody of their voices. The birds of the torrid zone are very bright and vivid in their colours; but they have screaming voices, or are totally silent. The frigid zone, on the other hand, where the seas abound with fish, are stocked with birds of the aquatic kind, in much greater plenty than in Europe; and these are generally clothed with a warmer coat of feathers: or they have large quantities of fat lying underneath the skin, which serves to defend them from the rigours of the climate.

In all countries, however, birds are a more long-lived class of animals than the quadrupeds or insects of the same climate. The life of man himself is but short, when compared to what some of them enjoy. It is said that swans have been known to live three hundred years; geese are often seen to live four-score; while linnets and other little birds, though imprisoned in cages, are often found to reach fourteen or fifteen. How birds, whose age of perfection is much more early than that of quadrupeds, should yet live comparatively so much longer, is not easily to be accounted for: perhaps, as their bones are lighter, and more porous than those of quadrupeds, there are fewer obstructions in the animal machine; and nature thus finding more room for the operations of life, is carried on to a greater extent.

All birds in general are less than quadrupeds; that is, the greatest of one class far surpass the greatest of the other in magnitude. The ostrich, which is the greatest of birds, bears no proportion to the elephant; and the smallest humming bird, which is the least of the class, is still far more minute than the mouse. In these the extremities of nature are plainly discernible; and in forming them she appears to have been doubtful

texture of the body. It is well known that if any part of the body be frost-bitten, an incautious application of heat infallibly produces mortification, and destroys the part. There is a remarkable example, in the 28th volume of the Philosophical Transactions, page 265, of a woman almost naked lying buried for six days under the snow, and yet recovering. In this case, it is scarcely possible to avoid supposing that the woman must have been in a state of torpor, otherwise she would certainly have endeavoured to find her way home. Many authentic facts prove the migration of our summer birds; and that they desert temperate zones at the approach of winter to seek a better climate in lower latitudes. Besides, all the tribe of birds of passage feed upon insects, which disappear and become torpid, either in a perfect or embryonic state, soon after the autumnal equinox: they are therefore compelled to migrate southward, in search of their natural food. The winter birds of passage forsake the frosty confines of the arctic circle, to spend the winter in the more temperate parts of Europe: the jacksnipe, redwing, woodcock, and fieldfare are of this tribe. About the end of April they return to the north, to pass the breeding season. It is also well known that swallows winter in different parts of Africa.—Ed.

in her operations: the ostrich, seemingly covered with hair, and incapable of flight, making near approaches to the quadruped class; while the humming-bird, of the size of an humble bee, and with a fluttering motion, seems nearly allied to the insect.

These extremities of this class are rather objects of human curiosity than utility: it is the middle order of birds which man has taken care to propagate and maintain. Of those which he has taken under his protection, and which administer to his pleasures or necessities, the greatest number seem creatures of his formation. The variety of climate to which he consigns them, the food with which he supplies them, and the purposes for which he employs them, produce amazing varieties both in their colours, shape, magnitude, and the taste of their flesh. Wild birds are, for the most part, of the same magnitude and shape; they still keep the prints of primeval nature strong upon them, except in a few; they generally maintain their very colour: but it is otherwise with domestic animals; they change at the will of man—of the tame pigeon, for instance, it is said that they can be bred to a feather.

As we are thus capable of influencing their form and colour, so also is it frequent to see equal instances of our influencing their habits, appetites, and passions. The cock, for instance, is artificially formed into that courage and activity which he is seen to possess: and many birds testify a strong attachment to the hand that feeds them. How far they are capable of instruction, is manifest to those that have the care of hawks. But a still more surprising instance of this was seen some time ago in London: a canary bird was taught to pick up the letters of the alphabet, at the word of command, so as to spell any person's name in company; and this the little animal did by motions from its master, which were imperceptible to every other spectator. Upon the whole, however, they are inferior to quadrupeds in docility; and seem more mechanically impelled by all the power of instinct.

CHAP. III.

OF THE DIVISION OF BIRDS.

THOUGH birds are fitted for sporting in the air, yet as they find their food upon the surface of the earth, there seems a variety equal to the different aliments with which it tends to supply them. The flat and burning desert, the rocky cliff, the extensive fen, the stormy ocean, as well as the pleasing landscape, have all their peculiar inhabitants. The most obvious distinction therefore of birds is into those that live by land and those that live by water; or in other words, into *land-birds* and *water-fowl*.

It is no difficult matter to distinguish land from water fowl, by the legs and toes. All land-birds have their toes divided, without any membrane or web between them; and their legs and feet serve them for the purposes of running, grasping, or climbing. On the other hand, water-fowl have their legs and feet formed for the purposes of wading in water, or swimming on its surface. In those that wade, the legs are usually long and naked; in those that swim, the toes are webbed together, as we see in the feet of a goose, which serve like oars to drive them forward with greater velocity. The formation, therefore, of land and water fowl is as distinct as their habits, and nature herself seems to offer us this obvious distribution, in methodizing animals of the feathered creation.

However, a distinction so comprehensive goes but a short way in illustrating the different tribes of so numerous a class. The number of birds already known amounts to above eight hundred;¹ and every person who turns his mind to these kinds of pursuits, is every day adding to the catalogue. It is not enough, therefore, to be able to distinguish a land from a water fowl; much more is still required—to be able to distinguish the different kinds of birds from each other; and even the varieties in the same kind, when they happen to offer. This certainly is a work of great difficulty; and perhaps the attainment will not repay the labour. The sensible part of mankind will not withdraw all their attention from more important pursuits, to give it entirely up to what promises to repay them only with a very confined species of amusement. In my distribution of birds, therefore, I will follow Linnæus in the first sketch of his system, and then leave him to follow the most natural distinctions in enumerating the different kinds that admit of a history or require a description.

Linnæus divides all birds into six classes: namely, into birds of the *rapacious kind*, birds of the *pie kind*, birds of the *poultry kind*, birds of the *sparrow kind*, birds of the *duck kind*, birds of the *crane kind*. The first four comprehend the various kinds of land birds; the two last, those that belong to the water.

Birds of the *rapacious kind* constitute that class of carnivorous fowl that live by rapine. He distinguishes them by their beak, which is hooked, strong, and notched at the point; by their legs, which are short and muscular, and made for the purpose of tearing; by their toes, which are strong and knobbed; and their talons, which are sharp and crooked; by the make of their body, which is muscular; and their flesh, which is impure: nor are they less known by their food, which consists entirely of flesh; their stomach, which is membranous; and their manners, which are fierce and cruel.

¹ Since Goldsmith's time nearly three thousand species of birds have been ascertained, and many of the species have several varieties.—ED.

Birds of the *pie kind* have the bill differing from the former: as in those it resembled a hook destined for tearing to pieces; in these it resembles a wedge fitted for the purpose of cleaving. Their legs are formed short and strong for walking; their body is slender and impure, and their food miscellaneous. They nestle in trees, and the male feeds the female during the time of incubation.

Birds of the *poultry kind* have the bill a little convex, for the purposes of gathering their food. The upper chap hangs over the lower; their bodies are fat and muscular, and their flesh white and pure. They live upon grain, which is moistened in the crop. They make their nest on the ground without art; they lay many eggs, and use promiscuous venery.

Birds of the *sparrow kind* comprehend all that beautiful and vocal class that adorn our fields and groves, and gratify every sense in its turn. Their bill may be compared to a forceps that catches hold; their legs are formed for hopping along; their bodies are tender; pure in such as feed upon grain, impure in such as live upon insects. They live chiefly in trees; their nests are artificially made, and their amours are observed with connubial fidelity.

Birds of the *duck kind* use their bill as a kind of strainer to their food; it is smooth, covered with a skin, and nervous at the point. Their legs are short, and their feet formed for swimming, the toes being webbed together: their body is fat, inclining to rancidity. They live in waters, and chiefly build their nests upon land.

With respect to the order of birds that belong to the waters, those of the *crane kind* have their bill formed for the purposes of searching and examining the bottom of pools; their legs are long, and formed for wading; their toes are not webbed; their thighs are half naked; their body is slender, and covered with a very thin skin; their tail is short and their flesh savoury. They live in lakes upon animals, and they chiefly build their nests upon the ground.

Such is the division of Linnæus with respect to this class of animals; and at first sight it appears natural and comprehensive. But we must not be deceived by appearances; the student, who should imagine he was making a progress in the history of nature, while he was only thus making arbitrary distributions, would be very much mistaken. Should he come to enter deeper into this naturalist's plan, he would find birds the most unlike in nature thrown together into the same class; and find animals joined, that entirely differ in climate, in habitudes, in manners, in shape, colouring, and size. In such a distribution, for instance, he would find the humming-bird and the raven, the rail and the ostrich, joined in the same family. If, when he asked what sort of a creature was the humming-bird, he were told that it was in the same class with the carrion-crow, would he not think himself

imposed upon! In such a case the only way to form any idea of the animal whose history he is desirous to know, is to see it; and that curiosity very few have an opportunity of gratifying. The number of birds is so great, that it might exhaust the patience not only of the writer but the reader, to examine them all: in the present confined undertaking it would certainly be impossible. I will, therefore, now attach myself to a more natural method; and still keeping the general division of Linnæus before me, enter into some description of the most noted, or the most worth knowing.

Under one or other class, as I shall treat them, the reader will probably find all the species, and all the varieties that demand his curiosity. When the leader of any tribe is described, and its history known, it will give a very tolerable idea of all the species contained under it. It is true, the reader will not thus have his knowledge ranged under such precise distinctions; nor can he be able to say with such fluency, that the rail is of the ostrich class; but what is much more material, he will have a tolerable history of the bird he desires to know, or at least of that which most resembles it in nature.

However, it may be proper to apprise the reader, that he will not here find his curiosity satisfied, as in the former volumes, where we often took Mr. Buffon for our guide. Those who have hitherto written the natural history of birds have in general been contented with telling their names, or describing their toes or their plumage. It must often, therefore, happen, that instead of giving the history of a bird, we must be content to entertain the reader with merely its description. I will, therefore, divide the following history of birds, with Linnæus, into six parts; in the first of which I will give such as Brisson has ranged among the rapacious birds; next those of the pie kind; and thus go on through the succeeding classes, till I finish with those of the duck kind. But before I enter upon a systematic detail, I will beg leave to give the history of three or four birds, that do not well range in any system. These, from their great size, are sufficiently distinguishable from the rest; and from their incapacity of flying, lead a life a good deal differing from the rest of the feathered creation. The birds I mean are the Ostrich, the Cassowary, the Emu, the Dodo, and the Solitaire.

BOOK II.

OF THE OSTRICH, EMU, CASSOWARY, AND DODO.

CHAP. I.

THE OSTRICH.

IN beginning with the feathered tribe, the first animal that offers seems to unite the class of quadrupeds and of birds in itself. While it has the general outline and properties of a bird, yet it retains many of the marks of the quadruped. In appearance the ostrich resembles the camel, and is almost as tall; it is covered with a plumage that resembles hair much more nearly than feathers, and its internal parts bear as near a similitude to those of the quadruped as of the bird creation. It may be considered, therefore, as an animal made to fill up that chasm in nature which separates one class of beings from another.

The ostrich is the largest of all birds. Travelers affirm, that they are seen as tall as a man on horseback; and even some of those that have been brought into England were above seven feet high. The head and bill somewhat resemble those of a duck; and the neck may be likened to that of a swan, but that it is much longer;

the legs and thighs resemble those of a hen; though the whole appearance bears a strong resemblance to that of a camel. But to be more particular: it is usually seven feet high from the top of the head to the ground; but from the back it is only four; so that the head and neck are above three feet long. From the top of the head to the rump, when the neck is stretched out in a right line, it is six feet long, and the tail is about a foot more. One of the wings, without the feathers, is a foot and a half; and being stretched out, with the feathers, is three feet.

The plumage is much alike in all; that is, generally black and white; though some of them are said to be gray. The greatest feathers are at the extremities of the wings and tail, and the largest are generally white. The next row is black and white; and of the small feathers, on the back and belly, some are white and others black. There are no feathers on the sides, nor yet on the thighs, nor under the wings. The lower part of the neck, about half way, is covered with still smaller feathers than those on the belly and back; and those, like the former, also are of different colours.

All these feathers are of the same kind, and peculiar to the ostrich; for other birds have several sorts, some of which are soft and downy, and others hard and strong. Ostrich feathers are almost all as soft as down, being utterly unfit to serve the animal for flying, and still less adapted to be a proper defence against external injury. The feathers of other birds have the webs broader on one side than the other, but those of the ostrich have their shaft exactly in the middle. The upper part of the head and neck is covered with a very fine, clear, white hair that shines like the bristles of a hog; and in some places there are small tufts of it, consisting of about twelve hairs, which grow from a single shaft about the thickness of a pin.

At the end of each wing there is a kind of spur, almost like the quill of a porcupine. It is an inch long, being hollow, and of a horny substance. There are two of these on each wing, the largest of which is at the extremity of the bone of the wing, and the other a foot lower. The neck seems to be more slender in proportion to that of other birds, from its not being furnished with feathers. The skin in this part is of a livid flesh-colour, which some improperly would have to be blue. The bill is short and pointed, and two inches and a half at the beginning. The external form of the eye is like that of man, the upper eye-lid being adorned with eye-lashes, which are longer than those on the lid below. The tongue is small, very short, and composed of cartilages, ligaments, and membranes, intermixed with fleshy fibres. In some it is about an inch long, and very thick at the bottom. In others it is but half an inch, being a little forked at the end.

The thighs are very fleshy and large, being covered with a white skin, inclining to redness, and wrinkled in the manner of a net, whose meshes will admit the end of a finger. Some have very small feathers here and there on the thighs; and others again have neither feathers nor wrinkles. What are called the legs of birds, in this are covered before with large scales. The end of the foot is cloven, and has two very large toes, which, like the leg, are covered with scales. These toes are of unequal sizes. The largest, which is on the inside, is seven inches long, including the claw, which is near three-fourths of an inch in length, and almost as broad. The other toe is but four inches long, and is without a claw.

The internal parts of this animal are formed with no less surprising peculiarity. At the top of the breast, under the skin, the fat is two inches thick; and on the fore-part of the belly it is as hard as suet, and about two inches and a half thick in some places. It has two distinct stomachs. The first, which is lowermost, in its natural situation somewhat resembles the crop in other birds; but it is considerably larger than the other stomach, and is furnished with strong muscular fibres, as well circular as longitudinal.

The second stomach, or gizzard, has outwardly the shape of the stomach of a man; and, upon opening, is always found filled with a variety of discordant substances; hay, grass, barley, beans, bones, and stones, some of which exceed in size a pullet's egg. The kidneys are eight inches long and two broad, and differ from those of other birds in not being divided into lobes. The heart and lungs are separated by a midriff, as in quadrupeds, and the parts of generation also bear a very strong resemblance and analogy.

Such is the structure of this animal, forming the shade that unites birds and quadrupeds; and from this structure its habits and manners are entirely peculiar. It is a native only of the torrid regions of Africa, and has long been celebrated by those who have had occasion to mention the animals of that region. Its flesh is proscribed in scripture as unfit to be eaten; and most of the ancient writers describe it as well known in their times. Like the race of the elephant, it is transmitted down without mixture; and has never been known to breed out of that country which first produced it. It seems formed to live among the sandy and burning deserts of the torrid zone; and, as in some measure it owes its birth to their genial influence, so it seldom migrates into tracts more mild or more fertile. As that is the peculiar country of the elephant, the rhinoceros, and the camel, so it may readily be supposed capable of affording a retreat to the ostrich. They inhabit, from preference, the most solitary and horrid deserts, where there are few vegetables to clothe the surface of the earth, and where the rain never comes to refresh it. The Arabians assert that the ostrich never drinks; and the place of its habitation seems to confirm the assertion. In these formidable regions, ostriches are seen in large flocks, which to the distant spectator appear like a regiment of cavalry, and have often alarmed a whole caravan. There is no desert, how barren soever, but what is capable of supplying these animals with provision; they eat almost every thing; and these barren tracts are thus doubly grateful, as they afford both food and security. The ostrich is, of all other animals, the most voracious. It will devour leather, glass, hair, iron, stones, or any thing that is given. Nor are its powers of digestion less in such things as are digestible. Those substances which the coats of the stomach cannot soften, pass whole; so that glass, stones, or iron, are excluded in the form in which they were devoured. All metals, indeed, which are swallowed by any animal, lose a part of their weight, and often the extremities of their figure, from the action of the juices of the stomach upon their surface. A quarter pistole, which was swallowed by a duck, lost seven grains of its weight in the gizzard before it was voided; and it is probable that a still greater diminution of weight would happen in the stomach of an ostrich. Considered in this light, therefore, this animal may be said to digest iron;

but such substances seldom remain long enough in the stomach of any animal to undergo so tedious a dissolution. However this be, the ostrich swallows almost every thing presented to it. Whether this be from the necessity which smaller birds are under of picking up gravel to keep the coats of their stomach asunder, or whether it be from a want of distinguishing by the taste what substances are fit and what incapable of digestion; certain it is, that in the ostrich dissected by Ranby there appeared such a quantity of heterogeneous substances, that it was wonderful how any animal could digest such an overcharge of nourishment. Valisneri also found the first stomach filled with a quantity of incongruous substances; grass, nuts, cords, stones, glass, brass, copper, iron, tin, lead, and wood; a piece of stone was found among the rest that weighed more than a pound. He saw one of these animals that was killed by devouring a quantity of quicklime. It would seem that the ostrich is obliged to fill up the great capacity of its stomach in order to be at ease; but that nutritious substances not occurring, it pours in whatever offers to supply the void.

In their native deserts, however, it is probable they live chiefly upon vegetables, where they lead an inoffensive and social life; the male, as Thevenot assures us, assorting with the female with connubial fidelity. They are said to be very much inclined to venery; and the make of the parts in both sexes seems to confirm the report. It is probable also they copulate, like other birds, by compression; and they lay very large eggs, some of them being above five inches in diameter, and weighing above fifteen pounds. These eggs have a very hard shell, somewhat resembling those of the crocodile, except that those of the latter are less and rounder.¹

¹ The ostrich is one of the few polygamous birds found in a state of nature; one male being generally seen with two or three, and frequently with five females. The females which are united to one male deposit all their eggs in the same place, to the number of ten or twelve each: these they hatch altogether; the male also taking his turn of sitting on them. Between sixty and seventy eggs have sometimes been found in one nest. The time of incubation is six weeks. From the want of knowledge that the ostrich is polygamous, Linnæus has suffered an error respecting this bird to slip into his *Systema Naturæ*, where it is asserted, that one female sometimes lays nearly fifty eggs. M. Le Vaillant informs us, that he started an ostrich from its nest, in Africa, where he found eleven eggs quite warm, and four others at a short distance. Those in the nest had young ones in them; but his attendants eagerly caught up the detached ones, assuring him that they were perfectly good to eat. They informed him, that near the nest there are always placed a certain number of eggs which the birds do not sit upon, and which are designed for the first nourishment of their future young. "Experience," says M. Le Vaillant, "has convinced me of the truth of this observation; for I never afterwards met with an ostrich's nest, without finding eggs deposited in this manner, at a small distance from it."

The season for laying depends on the climate where the animal is bred. In the northern parts of Africa, this season is about the beginning of July: in the south, it is about the latter end of December. These birds are very prolific, and lay generally from forty to fifty eggs at one clutch. It has been commonly reported that the female deposits them in the sand; and, covering them up, leaves them to be hatched by the heat of the climate, and then permits the young to shift for themselves. Very little of this, however, is true: no bird has a stronger affection for her young than the ostrich, nor none watches her eggs with greater assiduity. It happens, indeed, in those hot climates, that there is less necessity for the continual incubation of the female; and she more frequently leaves her eggs which are in no fear of being chilled by the weather: but though she sometimes forsakes them by day, she always carefully broods over them by night; and Kolben, who has seen great numbers of them at the Cape of Good Hope, affirms that they sit on their eggs like other birds, and that the male and female take this office by turns, as he had frequent opportunities of observing. Nor is it more true what is said of their forsaking their young after they are excluded the shell. On the contrary, the young ones are not even able to walk for several days after they are hatched. During this time, the old ones are very assiduous in supplying them with grass, and very careful to defend them from danger; nay, they encounter every danger in their defence. It was a way of taking them among the ancients, to plant a number of sharp stakes round the ostrich's nest in her absence, upon which she pierced herself at her return. The young, when brought forth, are of an ash-colour the first year, and are covered with feathers all over. But in time these feathers drop; and those parts which are covered assume a different and more becoming plumage.

The beauty of a part of this plumage, particularly the long feathers that compose the wings and tail, is the chief reason that man has been so active in pursuing this harmless bird to its deserts, and hunting it with no small degree of expense and labour. The ancients used those plumes in their helmets; the ladies of the East make them an ornament in their dress; and, among us, our undertakers and our fine gentle-

Some time after this M. Le Vaillant found a female ostrich on a nest containing thirty-two eggs; and twelve eggs were arranged at a little distance, each in a separate cavity formed for it. He remained near the place some time, and saw three other females come and alternately seat themselves on the nest; each sitting for about a quarter of an hour, and then giving place to another, who, while waiting, sat close by the side of her whom she was to succeed. If the eggs are touched by any person in the absence of the parents, they immediately discover it by the scent, at their return; and not only desist from laying any more in the same place, but trample to pieces with their feet all those that have been left.

men still make use of them to decorate their hearse and their hats. Those feathers which are plucked from the animal while alive, are much more valued than those taken when dead; the latter being dry, light, and subject to be worm-eaten.

Beside the value of their plumage, some of the savage nations of Africa hunt them also for their flesh, which they consider as a dainty. They sometimes also breed these birds tame, to eat the young ones, of which the female is said to be the greatest delicacy. Some nations have obtained the name of *Struthophagi*, or ostrich-eaters, from their peculiar fondness for this food; and even the Romans themselves were not averse to it. Apicius gives a receipt for making sauce for the ostrich; and Heliogabalus is noted for having dressed the brains of six hundred ostriches in one dish; for it was his custom never to eat but of one dish in a day, but that was an expensive one. Even among the Europeans now, the eggs of the ostrich are said to be well tasted, and extremely nourishing; but they are too scarce to be fed upon, although a single egg be a sufficient entertainment for eight men.

As the spoils of the ostrich are thus valuable, it is not to be wondered at that man has become their most assiduous pursuer. For this purpose, the Arabians train up their best and fleetest horses, and hunt the ostrich still in view. Perhaps of all other varieties of the chase, this, though the most laborious, is yet the most entertaining. As soon as the hunter comes within sight of his prey, he puts on his horse with a gentle gallop, so as to keep the ostrich still in sight; yet not so as to terrify him from the plain into the mountains. Of all known animals that make use of their legs in running, the ostrich is by far the swiftest; upon observing himself therefore pursued at a distance, he begins to run at first but gently; either insensible of his danger, or sure of escaping. In this situation he somewhat resembles a man at full speed; his wings, like two arms, keep working with a motion correspondent to that of his legs; and his speed would very soon snatch him from the view of his pursuers; but, unfortunately for the silly creature, instead of going off in a direct line, he takes his course in circles; while the hunters still make a small course within, relieve each other, meet him at unexpected turns, and keep him thus still employed, still followed for two or three days together. At last, spent with fatigue and famine, and finding all power of escape impossible, he endeavours to hide himself from those enemies he cannot avoid, and covers his head in the sand, or the first thicket he meets. Sometimes, however, he attempts to face his pursuers; and though in general the most gentle animal in nature, when driven to desperation, he defends himself with his beak, his wings, and his feet. Such is the force of his motion, that a man would be utterly unable to withstand him in the shock.

The *Struthophagi* have another method of taking this bird; they cover themselves with an ostrich's skin, and passing up an arm through the neck, thus counterfeit all the motions of this animal. By this artifice they approach the ostrich, which becomes an easy prey. He is sometimes also taken by dogs and nets, but the most usual way is that mentioned above.

When the Arabians have thus taken an ostrich, they cut its throat, and making a ligature below the opening, they shake the bird, as one would rinse a barrel; then taking off the ligature, there runs out from the wound in the throat a considerable quantity of blood, mixed with the fat of the animal; and this is considered as one of their greatest dainties. They next flay the bird; and of the skin, which is strong and thick, sometimes make a kind of vest, which answers the purposes of a cuirass and a buckler.

There are others who, more compassionate or more provident, do not kill their captive, but endeavour to tame it, for the purposes of supplying those feathers which are in so great request. The inhabitants of Dara and Lybia breed up whole flocks of them, and they are tamed with very little trouble. But it is not for their feathers alone that they are prized in this domestic state; they are often ridden upon, and used as horses. Moore assures us, that at Joar he saw a man travelling upon an ostrich; and Adanson asserts, that, at the factory of Podore, he had two ostriches, which were then young, the strongest of which ran swifter than the best English racer, although he carried two negroes on his back. As soon as the animal perceived that it was thus loaded, it set off running with all its force, and made several circuits round the village; till at length the people were obliged to stop it, by barring up the way. How far this strength and swiftness may be useful to mankind, even in a polished state, is a matter that perhaps deserves inquiry. Posterity may avail themselves of this creature's abilities; and riding upon an ostrich may one day become the favourite, as it most certainly is the swiftest, mode of conveyance.

The parts of this animal are said to be convertible to many salutary purposes in medicine. The fat is said to be emollient and relaxing; that while it relaxes the tendons, it fortifies the nervous system; and being applied to the region of the loins, it abates the pains of the stone in the kidneys. The shell of the egg powdered, and given in proper quantities, is said to be useful in promoting urine, and dissolving the stone in the bladder. The substance of the egg itself is thought to be peculiarly nourishing; however, Galen, in mentioning this, asserts that the eggs of hens and pheasants are good to be eaten; those of geese and ostriches are the worst of all.

CHAP. II.

THE EMU.

OF this bird, which many call the American Ostrich, but little is certainly known. It is an inhabitant of the New Continent; and the travellers who have mentioned it, seem to have been more solicitous in proving its affinity to the ostrich, than in describing those peculiarities which distinguish it from all others of the feathered creation.

It is chiefly found in Guiana, along the banks of the Oroonoko, in the inland provinces of Brazil and Chili, and the vast forests that border on the mouth of the river Plata. Many other parts of South America were known to have them; but as men multiplied, these large and timorous birds either fell beneath their superior power, or fled from their vicinity.

The Emu, though not so large as the ostrich, is only second to it in magnitude. It is by much the largest bird in the new continent; and is generally found to be six feet high, measuring from its head to the ground. Its legs are three feet long; and its thigh is near as thick as that of a man. The toes differ from those of the ostrich; as there are three in the American bird, and but two in the former. Its neck is long, its head small, and the bill flattened, like that of the ostrich; but in all other respects it more resembles the cassowary, a large bird to be described hereafter. The form of the body appears round; the wings are short, and entirely unfitted for flying, and it wants a tail. It is covered from the back and rump with long feathers, which fall backward, and cover the anus; these feathers are gray upon the back, and white on the belly. It goes very swiftly, and seems assisted in its motion by a kind of tubercle behind, like a heel, upon which, on plain ground, it treads very securely; in its course it uses a very odd kind of action, lifting up one wing, which it keeps elevated for a time; till letting it drop, it lifts up the other. What the bird's intention may be in thus keeping only one wing up, is not easy to discover; whether it makes use of this as a sail to catch the wind, or whether as a rudder to turn its course, in order to avoid the arrows of the Indians, yet remains to be ascertained: however this be, the emu runs with such swiftness, that the fleetest dogs are thrown out in the pursuit. One of them, finding itself surrounded by the hunters, darted among the dogs with such fury, that they made way to avoid its rage; and it escaped, by its amazing velocity, in safety to the mountains.

As this bird is but little known, so travellers have given a loose to their imaginations in describing some of its actions, which they were conscious could not be easily contradicted. This animal, says Nierenberg, is very peculiar in

hatching of its young. The male compels twenty or thirty of the females to lay their eggs in one nest; he then, when they have done laying, chases them away, and places himself upon the eggs; however, he takes the singular precaution of laying two of the number aside, which he does not sit upon. When the young ones come forth, these two eggs are added; which the male having foreseen, breaks one, and then the other, upon which multitudes of flies are found to settle; and these supply the young brood with a sufficiency of provision, till they are able to shift for themselves.

On the other hand, Wafer asserts, that he has seen great quantities of this animal's eggs on the desert shores, north of the river Plata; where they were buried in the sand, in order to be hatched by the heat of the climate. Both this as well as the preceding account may be doubted; and it is more probable that it was the crocodile's eggs which Wafer had seen, which are undoubtedly hatched in that manner.

When the young ones are hatched, they are familiar, and follow the first person they meet. I have been followed myself, says Wafer, by many of these young ostriches; which, at first, are extremely harmless and simple; but as they grow older, they become more cunning and distrustful; and run so swift, that a greyhound can scarcely overtake them. Their flesh, in general, is good to be eaten; especially if they be young. It would be no difficult matter to rear up flocks of these animals tame, particularly as they are naturally so familiar: and they might be found to answer domestic purposes, like the hen or the turkey. Their maintenance could not be expensive, if, as Narborough says, they live entirely upon grass.

CHAP. III.

THE CASSOWARY.¹

THE Cassowary is a bird which was first brought into Europe by the Dutch, from Java, in the East Indies, in which part of the world it is only to be found. Next to the preceding, it is the largest and the heaviest of the feathered species.

The cassowary, though not so large as the former, yet appears more bulky to the eye; its body being nearly equal, and its neck and legs much thicker and stronger in proportion; this conformation gives it an air of strength and force, which the fierceness and singularity of its countenance conspire to render formidable. It is five feet and a half long, from the point of the bill to the extremity of the claws. The legs are two feet and a half high, from the belly to the end of the claws. The head and neck together are a foot

¹ This is also called the Emu.—En.

and a half; and the largest toe, including the claw, is five inches long. The claw alone of the least toe is three inches and a half in length. The wing is so small, that it does not appear; it being hid under the feathers of the back. In other birds, a part of the feathers serve for flight, and are different from those that serve for merely covering; but in the cassowary, all the feathers are of the same kind, and outwardly of the same colour. They are generally double; having two long shafts, which grow out of a short one, which is fixed in the skin. Those that are double, are always of an unequal length; for some are fourteen inches long, particularly on the rump; while others are not above three. The beards that adorn the stem or shaft, are, from about half-way to the end, very long, and as thick as a horse hair, without being subdivided into fibres. The stem or shaft is flat, shining, black, and knotted below; and from each knot there proceeds a beard: likewise the beards at the end of the large feathers are perfectly black; and towards the root of a gray tawny colour; shorter, more soft, and throwing out fine fibres like down; so that nothing appears except the ends, which are hard and black; because the other part, composed of down, is quite covered. There are feathers on the head and neck; but they are so short and thinly sown, that the bird's skin appears naked, except towards the hinder part of the head, where they are a little longer. The feathers which adorn the rump are extremely thick; but do not differ, in other respects, from the rest, excepting their being longer. The wings, when they are deprived of their feathers, are but three inches long; and the feathers are like those on the other parts of the body. The ends of the wings are adorned with five prickles, of different lengths and thickness, which bend like a bow; these are hollow from the roots to the very points, having only that slight substance within which all quills are known to have. The longest of these prickles is eleven inches; and it is a quarter of an inch in diameter at the root, being thicker there than towards the extremity; the point seems broken off.

The part, however, which most distinguishes this animal is the head: this, though small, like that of an ostrich, does not fail to inspire some degree of terror. It is bare of feathers, and is in a manner armed with a helmet of horny substance, that covers it from the root of the bill to near half the head backwards. This helmet is black before and yellow behind. Its substance is very hard, being formed by the elevation of the bone of the skull; and it consists of several plates, one over another, like the horn of an ox. Some have supposed that this was shed every year with the feathers; but the most probable opinion is, that it only exfoliates slowly like the beak. To the peculiar oddity of this natural armour may be added the colour of the eye in this animal, which is a bright yellow, and

the globe being above an inch and a half in diameter, gives it an air equally fierce and extraordinary. At the bottom of the upper eye-lid, there is a row of small hairs, over which there is another row of black hair, which look pretty much like an eye-brow. The lower eye-lid, which is the largest of the two, is furnished also with plenty of black hair. The hole of the ear is very large and open, being only covered with small black feathers. The sides of the head, about the eye and ear, being destitute of any covering, are blue, except the middle of the lower eye-lid, which is white. The part of the bill which answers to the upper jaw in other animals, is very hard at the edges above, and the extremity of it like that of a turkey-cock. The end of the lower mandible is slightly notched, and the whole is of a grayish brown, except a green spot on each side. As the beak admits a very wide opening, this contributes not a little to the bird's menacing appearance. The neck is of a violet colour, inclining to that of slate; and it is red behind in several places, but chiefly in the middle. About the middle of the neck before, at the rise of the large feathers, there are two processes formed by the skin, which resemble somewhat the gills of a cock, but that they are blue as well as red. The skin which covers the fore-part of the breast, on which this bird leans and rests, is hard, callous, and without feathers. The thighs and legs are covered with feathers, and are extremely thick, strong, straight, and covered with scales of several shapes; but the legs are thicker a little above the foot than in any other place. The toes are likewise covered with scales, and are but three in number; for that which should be behind is wanting. The claws are of a hard solid substance, black without, and white within.

The internal parts are equally remarkable. The cassowary unites with the double stomach of animals that live upon vegetables, the short intestines of those that live upon flesh. The intestines of the cassowary are thirteen times shorter than those of the ostrich. The heart is very small, being but an inch and a half long, and an inch broad at the base. Upon the whole, it has the head of a warrior, the eye of a lion, the defence of a porcupine, and the swiftness of a courser.

Thus formed for a life of hostility, for terrifying others, and for its own defence, it might be expected that the cassowary was one of the most fierce and terrible animals of the creation. But nothing is so opposite to its natural character, nothing so different from the life it is contented to lead. It never attacks others; and, instead of the bill, when attacked, it rather makes use of its legs, and kicks like a horse, or runs against its pursuer, beats him down, and treads him to the ground.

The manner of going of this animal is not less extraordinary than its appearance. Instead of going directly forward, it seems to kick up be

hind with one leg, and then making a bound onward with the other, it goes with such prodigious velocity, that the swiftest racer would be left far behind.

The same degree of voraciousness which we perceive in the ostrich, obtains as strongly here. The cassowary swallows every thing that comes within the capacity of its gullet. The Dutch assert, that it can devour not only glass, iron, and stones, but even live and burning coals, without testifying the smallest fear, or feeling the least injury. It is said, that the passage of the food through its gullet is performed so speedily, that even the very eggs which it has swallowed whole, pass through it unbroken, in the same form they went down. In fact, the alimentary canal of this animal, as was observed above, is extremely short; and it may happen that many kinds of food are indigestible in its stomach, as wheat or currants are to a man when swallowed whole.

The cassowary's eggs are of a gray ash colour, inclining to green. They are not so large nor so round as those of the ostrich. They are marked with a number of little tubercles of a deep green, and the shell is not very thick. The largest of these is found to be fifteen inches round one way, and about twelve the other.

The southern parts of the most eastern Indies seem to be the natural climate of the cassowary. His domain, if we may so call it, begins where that of the ostrich terminates. The latter has never been found beyond the Ganges; while the cassowary is never seen nearer than the islands of Banda, Sumatra, Java, the Molucca Islands, and the corresponding parts of the continent.² Yet even here this animal seems not to have multiplied in any considerable degree, as we find one of the kings of Java making a present of one of these birds to the captain of a Dutch ship, considering it as a very great rarity. The ostrich, that has kept in the desert, and unpeopled regions of Africa, is still numerous, and the unrivalled tenant of its own inhospitable climate. But the cassowary, that is the inhabitant of a more peopled and polished region, is growing scarcer every day. It is thus that in proportion as man multiplies, all the savage and noxious animals fly before him: at his approach they quit their ancient habitations, how adapted soever they may be to their natures, and seek a more peaceable, though barren, retreat; where they willingly exchange plenty for freedom, and encounter all the dangers of famine to avoid the oppressions of an unrelenting destroyer.

² A species of the cassowary has been discovered in New Holland; it is seven feet two inches long: the crown of its head flat, which with the neck and body are covered with bristly feathers, varied with brown and gray; its throat is nakedish, and of a bluish lead colour; the feathers of the body are a little incurved at the tip; its wings are hardly visible; its legs are of a brown colour, and its feet with three toes.—Ed.

CHAP. IV.

THE DODO.

MANKIND have generally made swiftness the attribute of birds; but the dodo has no title to this distinction. Instead of exciting the idea of swiftness by its appearance, it seems to strike the imagination as a thing the most unwieldy and inactive of all nature. Its body is massive, almost round, and covered with gray feathers; it is just barely supported upon two short thick legs, like pillars, while its head and neck rise from it in a manner truly grotesque. The neck, thick and puffy, is joined to the head, which consists of two great chaps, that open far behind the eyes, which are large, black, and prominent; so that the animal, when it gapes, seems to be all mouth. The bill, therefore, is of an extraordinary length, not flat and broad, but thick, and of a bluish white, sharp at the end, and each chap crooked in opposite directions. They resemble two pointed spoons that are laid together by the backs. From all this results a stupid and voracious physiognomy; which is still more increased by a bordering of feathers round the root of the beak, and which gives the appearance of a hood or cowl, and finishes this picture of stupid deformity. Bulk, which in other animals implies strength, in this only contributes to inactivity. The ostrich or the cassowary are no more able to fly than the animal before us; but then they supply that defect by their speed in running. The dodo seems weighed down by its own heaviness, and has scarcely strength to urge itself forward. It seems among birds what the sloth is among quadrupeds, an unresisting thing, equally incapable of flight or defence. It is furnished with wings, covered with soft ash-coloured feathers, but they are too short to assist it in flying. It is furnished with a tail, with a few small curled feathers; but this tail is disproportioned and displaced. Its legs are too short for running, and its body too fat to be strong. One would take it for a tortoise that had supplied itself with the feathers of a bird; and that thus dressed out with the instruments of flight, it was only still the more unwieldy.

This bird is a native of the Isle of France; and the Dutch, who first discovered it there, called it, in their language, the nauseous bird, as well from its disgusting figure as from the bad taste of its flesh. However, succeeding observers contradict the first report, and assert that its flesh is good and wholesome eating. It is a silly simple bird, as may very well be supposed from its figure, and is very easily taken. Three or four dodos are enough to dine a hundred men.

Whether the dodo be the same bird with that which some travellers have described under the bird of Nazareth, yet remains uncertain. The country from whence they both come is the same;

their incapacity of flying is the same; the form of the wings and body in both are similar; but the chief difference given is in the colour of the feathers, which in the female of the bird of Nazareth are said to be extremely beautiful; and in the length of their legs, which in the dodo are short; in the other, are described as long. Time and future observation must clear up these doubts; and the testimony of a single witness, who shall have seen both, will throw more light on the subject than the reasonings of a hundred philosophers.

NOTE A.

The Dodo, described above, has now become extinct, and its former existence has even been called in question by some writers. The following is a statement of all that is known regarding it. The Hollanders, who, in 1598, fitted out a fleet commanded by Admiral Cornelisz Van Neck, landed at the Isle of France, then generally called Mauritius, and before that known under the name of *Ilha do Cirne*, or *Cisne*, which had been imposed upon it by the Portuguese, and signifying 'the isle of swans.' They there found birds as bulky as a swan, which had on a very thick head a sort of capote of skin, and but three or four black feathers in place of wings, and four or five small grayish feathers, and frizzled, instead of a tail. These birds were named by the Dutch *Walvogels*, which literally signifies *birds of disgust*, on account of the hardness of their flesh, which cooking only seemed to render more coriaceous, except that of the stomach, which was found tolerably good. A Dutch vessel set out from the Texel at the end of 1618, under the command of Bontekoe, and having landed at the Isle of Bourbon, then called Mascarenas, the crew found there the same kind of birds, which, so far from being able to fly, were so fat that they even walked with difficulty. The Hollanders named them *Dod-aers* or *Dod-aersen*. The relation of Bontekoe, inserted in Hakluyt's *Voyages*, contains a figure of one of them under the first of these names, but without any other details.

Clusius has described the same bird under the name of *gallus gallinaceus peregrinus*, and of *cygnus cucullatus*, which latter epithet is derived from some fancied resemblance between the membrane covering the bird's head, to the capote, or cowl, of a monk. He describes it as having the bill oblong, thick, and crooked, yellow at the base, bluish in the middle, and black at the extremity. The body, according to his statement, was covered only with some short feathers, and four or five black quills were in the place of wings. The hinder part of the body was very fat; and instead of tail there were four or five ash-coloured and frizzled feathers. The legs were rather short, and of an equal circumference throughout, covered with scales of a yellowish brown, from the knee to the toes. The same writer adds, that in the stomach of these birds were found stones of different forms and sizes, which, probably, they were in the habit of swallowing, like the granivorous birds to which systematists have associated them.

This description has been copied by Nieremberg; and Bontius, who has devoted to the dodo the seventeenth chapter of his 'Natural and Medical History of the East Indies,' adds, that it has large black eyes, mandibles the aperture of which is very ample, a curved neck, and a body so clumsy and fat, that its walk is very heavy.

The description of Willoughby differs but little from that of Clusius and Bontius; but he adds, that

he himself beheld the spoils of this bird in the museum of Sir John Tradescant.

Herbert, in his travels, tells us that the dodo weighed at least fifty pounds, and that the stomach was hot enough to digest stones. The weight would appear to be exaggerated, and the pretended faculty of digesting stones is utterly inadmissible.

The figure of the dodo, found in 'Edward's Gleanings,' was copied from a drawing made at the Mauritius from a living individual. This figure has served as a model for all others, and particularly those given by Dr. Latham, by Blumenbach, and by Shaw. The last writer, having remarked some relations between the bill of the dodo and that of the albatross, inquires, whether an inaccurate representation, done by a sailor, might not have given rise to the supposition of a new genus; but when he considers what excessive negligence it would be in any painter to represent a web-footed bird with cleft and separate toes, and to substitute simple winglets for wings of considerable extent, he dismisses this conjecture as of little weight. The same naturalist being determined to continue his researches, in consequence of the assertions of Charleton, who, in his 'Onomasticon Zoicon,' affirms that the bill and head of the dodo were then in the Museum of the Royal Society, and of Grew who mentions the leg of one of these birds among the curiosities of the British Museum, found the leg in question at the Museum, and another leg, with the bill and part of the cranium, in the Ashmolean Museum at Oxford, to which all the curious objects in that of Tradescant had been transferred. These two pieces came from the individual examined by Willoughby and Ray; and the foot, notwithstanding some injuries of time, seemed to him exactly like the one he had seen in London. Shaw gives the figures of them both, and declares that his doubts concerning the existence of the dodo were completely dispelled.

There are, unfortunately, no other facts than those we have stated which are calculated to throw any light on the existence of the dodo, which has never been seen in Europe since the era above-mentioned, when it was said that these birds were found in great numbers in the Isles of France, Bourbon, Rodrigue, and Sechelles. From the notes furnished by M. Morell to the Abbe Rozier, in 1778, and which were inserted in the 'Journal de Physique,' that all those monstrous birds called Dronte, or Dodo, Solitary Dodo, and Nazarene Dodo, were perfectly unknown to the oldest inhabitants of these islands, where they had not been seen for more than a century, it is impossible to conceive how birds of such weight, without proper wings, and not web-footed, consequently unable either to swim or fly, could cross the space which separates the islands which they have assigned as their habitation. This reflection, too, invalidates the conjecture of Grant, that the dodo may yet be found on the coasts of some uninhabited islands. The only mode remaining of enabling us to form any positive judgment on the bird in question, would be to examine and compare the earliest relations of the penguins and manchots, and to see what analogies may exist between them and the accounts of the dodo.

Mr. John V. Thomson, in a communication to the 'Magazine of Natural History,' on the subject, says: "Having resided some years amongst those islands, inclusive of Madagascar, and being curious to find whether any testimony could be obtained on the spot, as to the existence of the dodo in any of the islands of this or the neighbouring archipelagos, I may venture to say, that no traces of any kind could be found, no more than of the truth of the beautiful tale of 'Paul and Virginia,' although a very general belief prevailed as to both the one and the other. I there discovered, however, a copy of the scarce and curi-

ous voyage of Leguat, who, and his companions, appear to have been the first residents of Rodrigue; and, although some allowances appear to be necessary on account of the period in which he wrote, for descriptions and drawings apparently from memory, and a somewhat traveller-like sketch of imagination to enhance the value of his book; yet his evidence must be deemed conclusive, strengthened as it is by the collateral testimony of other voyagers, and by all the facts and statements brought forward by Mr. Duncan, in a paper upon this subject, published in the 'Zoological Journal' for January, 1828, p. 554: from which it appears, that a bird of corresponding size and character did actually exist, of which the only remains are a bill and foot in the Ashmolean museum at Oxford, and a foot in the British museum, all of which I had the satisfaction of examining on my return from the Mauritius in 1816.

Mr. Duncan, in the paper alluded to, proves that a specimen of this bird existed in Tradescant's museum at Lambeth, where it was seen by Ray and Willoughby. This museum being subsequently removed to Oxford by Dr. Ashmole, we find the specimen there in 1700, by the testimony of Hyde, in his 'Religionis Veterum Persarum, &c. Hist.:' and in a catalogue of the museum, drawn up since 1755, it is stated that "the Numbers from 5 to 46 (No. 29, being that of the dodo) being decayed, were ordered to be destroyed at a meeting of the visitors, Jan. 8, 1755." It is, therefore, almost certain that the bill and foot still to be seen in that depository, were those of the above specimen. To verify the painting, which is also to be seen in the British Museum, Mr. Duncan appears to have taken all the pains possible, and states it to have been drawn from a living bird, sent from the Mauritius to Holland, the Dutch being the first colonists of that island; to dissipate all doubts as to its accuracy, however, it should be collated with a description taken from the Ashmolean specimen, should such be found to exist.

The island of Rodrigue, or Diego Ruys, although seen by several of the earlier voyagers, after the discovery of the route to India by the Cape, does not appear to have been visited anterior to the voyage of Leguat, from its unapproachable appearance, and the apparent continuity of the extensive madreporitic reef which everywhere surrounds it, and upon which the sea continually breaks, at a very considerable distance from the shore: the same causes still operate in repelling the tide of colonization, as, at the time of our late conquest of the group to which it belongs, a single French family constituted the whole of its population. Leguat and his companions, then, may be presumed to have seen it in its virgin state; a circumstance which makes his narration doubly interesting, and shows not only the abundance of its animal productions, but the paradisiacal peace and amity which appeared to reign amongst them, and the little dread they seemed to possess at the presence of their destined destroyer. Of the dodo, he says:—

"Of all the birds which inhabit this island, the most remarkable is that which has been called Solitaire (the solitary), because they are rarely seen in flocks, although there is abundance of them. The males have generally a grayish or brown plumage, the feet of the turkey-cock, as also the beak, but a little more hooked. They have hardly any tail, and their posterior, covered with feathers, is rounded like the croup of a horse. They stand higher than the turkey-cock, and have a straight neck, a little longer in proportion than it is in that bird when it raises its head. The eye is black and lively, and the head without any crest or tuft. They do not fly, their wings being too short to support the weight of their bodies; they only use them in beating their sides, and in whirling round; when they wish to call

one another, they make, with rapidity, twenty or thirty rounds in the same direction, during the space of four or five minutes; the movement of their wings then makes a noise which approaches exceedingly that of a kestrel (*Creccerelle*), and which is heard at more than 200 paces distant. The bone of the false pinion is enlarged at its extremity, and forms, under the feathers, a little round mass like a musket-bullet: this and their beak form the principal defence of this bird. It is extremely difficult to catch them in the woods; but as a man runs swifter than they, in the more open spots it is not very difficult to take them; sometimes they may even be approached very easily. From the month of March until September, they are extremely fat, and of most excellent flavour, especially when young. The males may be found up to the weight of 45 lb.; Herbert even says 50 lb. The female is of admirable beauty. Some are of a blond, others of a brown, colour; I mean by blond the colour of flaxen hair. They have a kind of band, like the bandeau of widows, above the beak, which is of a tan colour. One feather does not pass another over all their body, because they take great care to adjust and polish them with their beak. The feathers which accompany the thighs are rounded into a shell-like form, and, as they are very dense at this place, produce a very agreeable effect. They have two elevations over the crop, of a somewhat whiter plumage than the rest, and which resemble wonderfully the fine breast of a woman. They walk with so much stateliness and grace combined, that it is impossible not to admire and love them; so much so, that their appearance has often saved their life. Although these birds approach, at times, very familiarly when they are not chased, they are incapable of being tamed; as soon as caught they drop tears, without crying, and refuse obstinately all kind of nourishment, until at last they die. There is always found in their gizzard (as well as in that of the males) a brown stone, the size of a hen's egg; it is slightly tuberculated (*raboteuse*), flat on one side, and rounded on the other, very heavy and very hard. We imagined that this stone was born with them, because, however young they might be, they always had it, and never more than one; and besides this circumstance, the canal which passes from the crop to the gizzard is by one half too small to give passage to such a mass. We used them, in preference to any other stone, to sharpen our knives. When these birds set about building their nests, they choose a clear spot, and raise it a foot and a half off the ground, upon a heap of leaves of the palm tree, which they collect together for the purpose. They only lay one egg, which is very much larger than that of a goose. The male and female sit by turns, and it does not hatch until after a period of seven weeks. During the whole period of incubation, or that they are rearing their young one, which is not capable of providing for itself until after several months, they will not suffer any bird of their own kind to approach within 200 paces of their nest; and what is very singular is, that the male never chases away the females; only, when he perceives one, he makes in whirling, his ordinary noise, to call his companion, which immediately comes and gives chase to the stranger, and which she does not quit until driven without their limits. The female does the same, and allows the males to be driven off by her mate. This is a circumstance that we have so often witnessed, that I speak of it with certainty. These combats last sometimes for a long time, because the stranger only turns off, without going in a straight line from the nest; nevertheless, the others never quit until they have chased them away."

We have, in this last relation of Leguat, who

• Voyage de Francois Leguat, Gentilhomme, Bressan, 1708.

resided in the midst of them for a considerable period, a detailed, although rude, description, and a natural history of the dodo, probably the only one that was ever penned under such favourable circumstances. No doubt this first colony, in so small an island, considerably reduced the number of the dodo: but when they finally disappeared does not appear to have been anywhere recorded. From the nature and habits of the bird, it is clear that the duration of the species was wholly incompatible with the dominion of man: had it been capable of domestication, or had it possessed the swiftness of foot of the ostrich, or the aquatic habits of the penguin, to compensate its want of the power of flying, they might still have shared some of the possessions originally assigned to the race; or even like the turkey-cock and goose, have administered to the wants of mankind, in every temperate region of the globe; under existing circumstances, however, they appear to have been what may be truly termed a paradisiacal bird, and predestined to disappear at their proper time. As they are the only vertebrated animals which we can make certain of having lost since the last creation, they furnish an interesting subject of meditation to the philosophic naturalist.

NOTE B.—*The Moa of the New Zealanders.*

In the 'Annals of Natural History' for August 1844, there is an account, by the Rev. W. Colenso, of some enormous fossil bones of an unknown species of bird, lately discovered in New Zealand. Mr. Colenso says: "It was during the summer of 1838 that I accompanied the Rev. W. Williams on a visit to the tribes inhabiting the East Cape district. Whilst at Waiapu (a thickly inhabited locality about twenty miles S.W. from the East Cape), I heard from the natives of a certain monstrous animal, which, while some said it was a bird, and others 'a person,' all agreed that it was called a *Moa*; that in general appearance it somewhat resembled an immense domestic cock, with the difference, however, of its possessing a 'face like a man;' that it dwelt in a cavern in the precipitous side of a mountain; that it lived on air, and was attended or guarded by two immense *Tuataras* [a species of lizard], who, Argus-like, kept incessant watch while the *Moa* slept; and that if any one possessing temerity sufficient dared to approach the dwelling of this wonderful creature, he would be infallibly killed by it: an act which it was said to execute much in the same manner as that by which those unhappy criminals are summarily punished in the dominions of the native Indian princes, by the trampling of an elephant, and at which feat this celebrated *Moa* was quite expert. A mountain, named Wakapunake, at least eighty miles distant in a southerly direction, was spoken of as the residence of this creature; where however only one existed, which one, it was contended by the many, was the sole survivor of the *Moa* race, although they could not assign any possible reason why it should have become all but extinct.

"In the summer of 1841-2, I again visited those parts. At Waiapu I gained the information, that Wakapunake (the mountain where the *Moa* was said to reside) had been visited by some baptized natives, purposely to ascertain the truth of the common belief, and which they declared to be altogether without foundation; finding neither cavern, nor lizard-guards, nor *Moa*, nor any signs of such uncommon *lusus naturæ*. But what was of far greater interest to me than this relation of theirs, were some bones which I had the good fortune to procure from them, and which were declared by the natives to be true *Moa* bones. These bones, seven in number, were all imperfect, and comprised five femora, one tibia,

and one which I have not yet been able satisfactorily to determine. The largest femur, consisting of the diaphysis only without the processes, measured 8 inches in length, and $4\frac{1}{2}$ inches in girth in the narrowest part. The portion of the tibia, which like the femur consisted only of the middle part, measured in length 6 inches, and in circumference 4 inches at the narrowest and 5 inches at the widest part. The remaining bone, the largest of all, which was merely a section, measured in length 6 inches, and in circumference $7\frac{1}{4}$ inches at the smallest part. These bones were all (excepting the last-mentioned) of a very dark colour, almost a ferruginous brown, and appeared to have entirely lost their oily matter. They were very stout, especially the tibia, and were strongly marked and indented on the outside with muscular impressions. What little remained within of the reticulated cells appeared to be nearly perfect. They were all found by the natives in the Waiapu river, and were collected by them for the purpose of cutting up and attaching to their fish-hooks, in order to fish. The portion of tibia which I obtained had been sawn across by the native in whose possession it was, for that purpose. I also obtained several hooks, each having portions of *Moa*'s bone attached to it. I could not however ascertain, from the smallness of the slips, whether these had been originally cut out of such bones as those I had just procured, or whether they had not been sawn from bones of a different description and larger size. Leaving Waiapu, and proceeding by the coast towards the south, I arrived at Poverty Bay, where the Rev. W. Williams resided. This gentleman had had the good fortune to procure a nearly whole tibia of an immense bird, without however the entire processes of either end. This bone measured about 18 inches in length, and was proportionably thick. Mr. Williams wishing to send this unique relic to Oxford, I left a pair of femora to accompany it, in order, if possible, to obtain from that seat of learning some light on these increasingly interesting remains. At Poverty Bay I made several inquiries after *Moa* bones, but to little purpose, as I could not obtain any.

"Quitting Poverty Bay, and still travelling in a southern direction, I soon came within sight of Wakapunake, the mountain celebrated as the residence of the only surviving *Moa*. As natives lived about its base, among whom my route lay, I looked forward with no small degree of interest to the obtaining at least some *Moa* relics in this locality; in this however I was disappointed. At the close of the second day's travel we arrived at 'Te Reinga' (a village situated at the foot of the mountain), where, as opportunity offered, I inquired of the natives relative to the *Moa*. In reply to my reiterated queries, they said that he lived there in the mountain, although they had never seen him, but that the *Moa* bones were very commonly found after floods occasioned by heavy rains, when they would be washed up on the banks of gravel in the sides of the rivers and exposed to their view; still they had not any at that time by them. I offered large rewards for any that should be found hereafter, and which were to be taken to Mr. Williams at Poverty Bay. Here, as at Waiapu, no one person could be found who possessed the hardihood positively to assert that he had seen the *Moa*, although this neighbourhood had ever been the dwelling-place of that tribe. The mountain, too, it appeared, was by no means unknown to them; for, during a war between themselves and the Urewera tribe a few years ago, they had fled for refuge to their stronghold on the top of Wakapunake, where they had lived for some time, and where many of their relatives eventually fell into the hands of the enemy, who starved them into a surrender and took the place. Here then was still further proof (if proof was wanting), that no such colossal animal

could possibly at this time be existing in this place. The spot, however, was well-chosen for the fiction of such a creature's residence: a huge, table-topped and lofty mountain, covered with primeval forests of gloomy pines; its brow singularly adorned with a horizontal stratum of whitish sandstone, which ran continuously and precipitously for more than two miles. At the base of the mountain ran the river Wangaroa, down which we paddled in canoes for some distance. This river is a branch of the Wairoa river, which disembogues into Hawkes' Bay. These natives further informed me that a Moa resided at a certain high mountain in Te 'Waiki district, nearly five days' journey into the interior, in a N.W. direction from the place where we now were, and that there I should find people who had actually seen the animal. If I was little inclined to believe in the story of its existence before, I was much less inclined to do so now; however, as my route lay that way, I determined to make every possible inquiry after it.

"Fifteen days after this I arrived at Te 'Waiki, the principal village of that district, and not far from the residence of the second Moa. Here, however, as before, the people had never seen a Moa, although they had always heard of, and invariably believed in, the existence of such a creature at that place. They, too, had not any bones in their possession; though such, they said, were very commonly seen after heavy floods. The following day I passed close by the mountain where this Moa had resided for so many years, but noticed nothing more than usual (although I availed myself to the utmost of the use of my pocket telescope), save that this part of the country had a much more barren and desolate appearance than any I had hitherto witnessed. I returned in the autumn to the Bay of Islands, without glean- ing any further information relative to the Moa.

"It should however appear (from information which I have recently received from the Rev. W. Williams), that very shortly after my leaving Poverty Bay, a Moa bone was brought him by a native which he immediately purchased. The natives in the neighbourhood hearing of a price being given for such an article as a bone, which they had ever considered as of little worth, were stimulated to exertion, and a great number, perhaps more than a hundred persons, were soon engaged in the field, actively searching after Moa bones; the result was, that Mr. Williams soon had the pleasure of receiving a large quantity of fossil bones, some of which were of an enormous size, and in a good state of preservation. The bones, though numerous, were not in any great variety, chiefly comprising such as I have already mentioned, i. e. those of the femur and tibia, together with those of the tarsus, the lower part of the dorsal vertebrae, and a portion of the pelvis. Altogether, the bones of nearly thirty birds, apparently of one species only, must have been brought to Mr. Williams. From the great difference in the sizes of some of them when compared with each other, Mr. Williams came to the conclusion, that the animal to which they once belonged must have been very long-lived. Whilst, however, I do not perceive how far this inference is to be correctly deduced from the mere difference in the size of the bones, we know that longevity is common to very many of the feathered race, particularly to those of the larger kinds. One of the bones, a tibia, measured 2 feet 10 inches in length, and was proportionably thick. Two others measured, each, 2 feet 6 inches in length. Another, a section of a femur, measured 8 inches in circumference in the smallest part! On putting together the bones of the leg and thigh (although none of them exactly fitted), and making the necessary allowance for the portions deficient of the processes of the joints, the intermediate cartilages, and lower tendons and integuments of the foot, we obtain at least six

feet of the lower extremities of a bird; which, supposing its upper parts to accord in size with the lower ones, must have measured in altitude when alive, at the lowest rate of calculation, from 14 to 16 feet!! An enormous feathered monster, well worthy, from its gigantic size, of being classed with the *Megalosaurus* of Buckland and the *Mastodon* of Cuvier.

"It so happened that about this time a mechanic, who had been living at Cloudy Bay in the Middle Island, came to reside at Poverty Bay. He stated that this bird now existed in the high hills near Cloudy Bay: and that two Americans, residents at that place, hearing from a native that such a bird lived on the mountainous and snowy heights, provided themselves with arms, and thus equipped, went in high expectation of shooting one, taking the native with them as their guide. They ascended the mountain to the place where these birds resort, and, at the native's request, hid themselves behind some bushes. Presently they saw the monster majestically stalking down in search of food; they were, however, so petrified with horror at the sight as to be utterly unable to fire on him. They observed him for near an hour, ere he retired, and were glad enough at last to make their escape. They described this animal as being about 14 or 16 feet in height."

Mr. Colenso, after stating his reasons for believing that the Moa no longer exists, proceeds to inquire at what period of time it is probable the gigantic creature indicated by such bones existed. "Unless," he says, "we suppose this immense bird to have existed at a period prior to the peopling of these islands by their present aboriginal inhabitants, how are we to account for its becoming extinct, and, like the dodo, blotted out of the list of the feathered race? From the bones of about thirty birds found at Turanga, in a very short time and with very little labour, we can but infer that it once lived in some considerable numbers; and, from the size of those bones, we conclude the animal to have been powerful as well as numerous. What enemies then had it to contend with in these islands, where, from its colossal size, it must have been paramount lord of the creation, that it should have ceased to be? Man, the only antagonist at all able to cope with it, we have already shown as being entirely ignorant of its habits, use, and manner of capture, as well as utterly unable to assign any reason why it should have thus perished. The period of time, then, in which I venture to conceive it most probable the Moa existed, was certainly either antecedent or coetaneous to the peopling of these islands by the present race of New Zealanders.

"But we will proceed, and endeavour to ascertain (as we proposed in the second place to do) to what order or family is it likely that the Moa belongs? In making this inquiry, we have little to assist us but the bones before us; from an attentive consideration of which we are necessarily led to conclude that the animal must have been of large size and great strength; and, from the shortness of the tarsus (when compared with the length of the tibia), we also perceive it to have been short-legged. From its size, we shall naturally be led to seek for its affinities among either the raptorial or rasorial orders; but from its tarsi possessing only articulations for three toes, we are at once precluded from supposing that it belonged to the former order; to which we may also add, first, the (so to speak) evidence of negation, of not a single specimen or fragment of a wing-bone having yet been found; and secondly, the judicious observation of Cuvier (in reference to the family of *struthionidae*), that it would be morally impossible to fit such heavy bodies with wings sufficient to enable them to fly. In the latter, however (the gallinaceous or rasorial order), we have the

largest and stoutest birds known; these too are terrestrial in their habits, some exclusively so, and very often possess only three toes. It is true, that in general the different known members of the family containing the largest birds have their tarsi long, (whereas those of the Moa, as we have already seen, are short,) yet to this we have exceptions in the Dodo (alas! no more) and the Apteryx. And I think it is highly worthy of notice, that the latter, the only known existing genus of the family possessing short tarsi, is entirely confined to these islands. From a conviction, then, that it is in this order only that the affinities of the Moa are to be sought with any prospect of success, and that it is in the family Struthionidæ where they will, doubtless, eventually be found, we are induced, for the present at least, to place the Moa in that gigantic group. In the absence, however, of a specimen of an Apteryx with which to compare, the few bones we at present pos-

sess of the Moa, I should, I confess, be hazarding an opinion in saying that it was most nearly allied to that peculiar genus; yet when we consider, that out of the five existing genera of this family, three at least, apparently possessing the nearest affinities to the remains of the bird before us, belong exclusively to the southernmost parts of the southern hemisphere, and that a connecting link is, as it were, wanting between the Rhea of the Straits of Magellan, the Dromiceus of New Holland, the Casuarius of the Indian Archipelago, and the Apteryx of New Zealand, and that this connecting link may, in all probability, be supplied in the Moa; I think we shall be constrained to assign our Moa a place between the genera Casuarius and Apteryx, possessing as it does (only in a much greater degree) the immense size and strength of the former, combined with the short tarsi, and probably wingless structure of the latter."

BOOK III.

OF RAPACIOUS BIRDS.

CHAP. I.

OF RAPACIOUS BIRDS IN GENERAL.

THERE seems to obtain a general resemblance in all the classes of nature. As among quadrupeds, a part were seen to live upon the vegetable productions of the earth, and another part upon the flesh of each other; so among birds, some live upon vegetable food, and others by rapine, destroying all such as want force or swiftness to procure their safety. By thus peopling the woods with animals of different dispositions, nature has wisely provided for the multiplication of life; since, could we suppose that there were as many animals produced as there were vegetables supplied to sustain them, yet there might still be another class of animals formed, which could find a sufficient sustenance by feeding upon such of the vegetable feeders as happened to fall by the course of nature. By this contrivance, a greater number will be sustained upon the whole; for the numbers would be but very thin were every creature a candidate for the same food. Thus, by supplying a variety of appetites, Nature has also multiplied life in her productions.

In thus varying their appetites, Nature has also varied the form of the animal; and while she has given some an instinctive passion for animal food, she has also furnished them with powers to obtain it. All land birds of the rapacious kinds are furnished with a large head, and a strong crooked beak, notched at the end, for the purpose of tearing their prey. They have strong short legs, and sharp crooked talons, for

the purpose of seizing it. Their bodies are formed for war, being fibrous and muscular; and their wings for swiftness of flight, being well-feathered and expansive. The sight of such as prey by day is astonishingly quick; and such as ravage by night have their sight so fitted as to see objects in darkness with extreme precision.

Their internal parts are equally formed for the food they seek for. Their stomach is simple and membranous, and wrapt in fat to increase the powers of digestion; and their intestines are short and glandular. As their food is succulent and juicy, they want no length of intestinal tube to form it into a proper nourishment. Their food is flesh; which does not require a slow digestion to be converted into a similitude of substance to their own.

Thus formed for war, they lead a life of solitude and rapacity. They inhabit by choice the most lonely places, and the most desert mountains. They make their nests in the cliffs of rocks, and on the highest and most inaccessible trees of the forest. Whenever they appear in the cultivated plain or the warbling grove, it is only for the purposes of depredation; and are gloomy intruders on the general joy of the landscape. They spread terror wherever they approach: all that variety of music which but a moment before enlivened the grove, at their appearing is instantly at an end: every order of lesser birds seeks for safety, either by concealment or flight; and some are even driven to take protection with man, to avoid their less merciful pursuers.

It would indeed be fatal to all the smaller race of birds, if, as they are weaker than all, they were

also pursued by all; but it is contrived wisely for their safety, that every order of carnivorous birds seek only for such as are of the size most approaching their own. The eagle flies at the bustard or the pheasant; the sparrow-hawk pursues the thrush and linnet. Nature has provided that each species should make war only on such as are furnished with adequate means of escape. The smallest birds avoid their pursuers by the extreme agility rather than the swiftness of their flight; for every order would soon be at an end, if the eagle, to its own swiftness of wing, added the versatility of the sparrow.

Another circumstance which tends to render the tyranny of these animals more supportable, is, that they are less fruitful than other birds; breeding but few at a time. Those of the larger kind seldom produce above four eggs, often but two; those of the smaller kinds, never above six or seven. The pigeon, it is true, which is their prey, never breeds above two at a time; but then she breeds every month in the year. The carnivorous kinds only breed annually, and of consequence their fecundity is small in comparison.

As they are fierce by nature, and are difficult to be tamed, so this fierceness extends even to their young, which they force from the nest sooner than birds of the gentler kind. Other birds seldom forsake their young till able completely to provide for themselves: the rapacious kinds expel them from their nest at a time when they still should protect and support them. This severity to their young proceeds from the necessity of providing for themselves. All animals that, by the conformation of their stomach and intestines, are obliged to live upon flesh, and support themselves by prey, though they may be mild when young, soon become fierce and mischievous, by the very habit of using those arms with which they are supplied by nature. As it is only by the destruction of other animals that they can subsist, they become more furious every day; and even the parental feelings are overpowered in their general habits of cruelty. If the power of obtaining a supply be difficult, the old ones soon drive their brood from the nest to shift for themselves, and often destroy them in a fit of fury caused by hunger.

Another effect of this natural and acquired severity is, that almost all birds of prey are unsociable. It has long been observed by Aristotle, that all birds with crooked beaks and talons are solitary: like quadrupeds of the cat kind, they lead a lonely wandering life, and are united only in pairs, by that instinct which overpowers their rapacious habits of enmity with all other animals. As the male and female are often necessary to each other in their pursuits, so they sometimes live together; but except at certain seasons, they most usually prowl alone; and, like robbers, enjoy in solitude the fruits of their plunder.

All birds of prey are remarkable for one singu-

larity, for which it is not easy to account. All the males of these birds are about a third less, and weaker than the females, contrary to what obtains among quadrupeds, among which the males are always the largest and the boldest: from thence the male is called by falconers a *tarcel*; that is, a tierce or third less than the other. The reason of this difference cannot proceed from the necessity of a larger body in the female for the purpose of breeding, and that her volume is thus increased by the quantity of her eggs; for in other birds, that breed much faster, and that lay in much greater proportion, such as the hen, the duck, or the pheasant, the male is by much the largest of the two.

Whatever be the cause, certain it is that the females, as Willoughby expresses it, are of greater size, more beautiful and lovely for shape and colours, stronger, more fierce and generous, than the males; whether it may be that it is necessary for the female to be thus superior, as it is incumbent upon her to provide, not only for herself, but her young ones also.

These birds, like quadrupeds of the carnivorous kind, are all lean and meagre. Their flesh is stringy and ill-tasted, soon corrupting, and tintured with the flavour of that animal food upon which they subsist. Nevertheless, Belonius asserts, that many people admire the flesh of the vulture and falcon, and dress them for eating, when they meet with any accident that unfits them for the chase. He asserts that the osprey, a species of the eagle, when young is excellent food; but he contents himself with advising us to breed these birds up for our pleasure rather in the field than for the table.

Of land birds of a rapacious nature,¹ there are five kinds. The eagle kind, the hawk kind, the vulture kind, the horned and the screech owl kind. The distinctive marks of this class are taken from their claws and beak: their toes are separated: their legs are feathered to the heel: their toes are four in number; three before, one behind: their beak is short, thick, and crooked.

The eagle kind is distinguished from the rest by his beak, which is straight till towards the end, when it begins to hook downwards.

The vulture kind is distinguished by the head and neck; which are without feathers.

The hawk kind by the beak; being hooked from the very root.

The horned owl by the feathers at the base of the bill standing forwards; and by some feathers on the head that stand out, resembling horns.

The screech-owl by the feathers at the base of

¹ The animals of this order are all carnivorous. They associate in pairs, build their nests in the most lofty situations, and produce generally four young ones at a brood. The female is generally larger than the male. They consist of vultures, eagles, hawks, and owls; and are divided into two sections,—the one containing the diurnal, the other the nocturnal species. The diurnal species are subdivided into two families, the vulturine and falconine.—Ed.

the bill standing forward, and being without horns. A description of one in each kind will serve for all the rest.

CHAP. II.

THE EAGLE AND ITS AFFINITIES.

THE Golden eagle is the largest and the noblest of all those birds that have received the name of eagle. It weighs above twelve pounds. Its length is three feet; the extent of its wings, seven feet four inches; the bill is three inches long, and of a deep blue colour; and the eye of a hazel colour. The sight and sense of smelling are very acute. The head and neck are clothed with narrow sharp-pointed feathers, and of a deep brown colour, bordered with tawny; but those on the crown of the head, in very old birds turn gray. The whole body, above as well as beneath, is of a dark brown; and the feathers of the back are finely clouded with a deeper shade of the same. The wings, when clothed, reach to the end of the tail. The quill-feathers are of a chocolate colour, the shafts white. The tail is of a deep brown, irregularly barred and blotched with an obscure ash-colour, and usually white at the roots of the feathers. The legs are yellow, short, and very strong, being three inches in circumference, and feathered to the very feet. The toes are covered with large scales, and armed with the most formidable claws, the middle of which are two inches long.

In the rear of this terrible bird follow the *ring-tailed eagle*, the *common eagle*, the *bald eagle*, the *white eagle*, the *kough-footed eagle*, the *erne*, the *black eagle*, the *osprey*, the *sea eagle*, and the *crowned eagle*. These, and others that might be added, form different shades in this fierce family; but have all the same rapacity, the same general form, the same habits, and the same manner of bringing up their young.

In general, these birds are found in mountainous and ill-peopled countries, and breed among the loftiest cliffs. They choose those places which are remotest from man, upon whose possessions they but seldom make their depredations, being contented rather to follow the wild game in the forest, than to risk their safety, to satisfy their hunger.

This fierce animal may be considered among birds as the lion among quadrupeds; and in many respects they have a strong similitude to each other. They are both possessed of force, and an empire over their fellows of the forest. Equally magnanimous, they disdain smaller plunder; and only pursue animals worthy the conquest. It is not till after having been long provoked, by the cries of the rook or the magpie, that this generous bird thinks fit to punish them with death: the eagle also disdains to share the

plunder of another bird; and will take up with no other prey but that which he has acquired by his own pursuits. How hungry soever he may be, he never stoops to carrion; and when satiated, he never returns to the same carcass, but leaves it for other animals, more rapacious and less delicate than he. Solitary, like the lion, he keeps the desert to himself alone; it is as extraordinary to see two pair of eagles in the same mountain, as two lions in the same forest. They keep separate, to find a more ample supply; and consider the quantity of their game as the best proof of their dominion. Nor does the similitude of these animals stop here: they have both sparkling eyes, and nearly of the same colour; their claws are of the same form, their breath equally strong, and their cry equally loud and terrifying. Bred both for war, they are enemies of all society: alike fierce, proud, and incapable of being easily tamed. It requires great patience and much art to tame an eagle; and even though taken young, and brought under by long assiduity, yet still it is a dangerous domestic, and often turns its force against its master.

When brought into the field for the purposes of fowling, the falconer is never sure of its attachment: that innate pride and love of liberty still prompt it to regain its native solitudes; and the moment the falconer sees it, when let loose, first stoop towards the ground, and then rise perpendicularly into the clouds, he gives up all his former labour for lost; quite sure of never beholding his late prisoner more. Sometimes, however, they are brought to have an attachment for their feeder; they are then highly serviceable, and liberally provide for his pleasures and support. When the falconer lets them go from his hand, they play about and hover round him till their game presents, which they see at an immense distance, and pursue with certain destruction.

Of all animals the eagle flies highest; and from thence the ancients have given him the epithet of *the bird of heaven*. Of all others also, he has the quickest eye; but his sense of smelling is far inferior to that of the vulture. He never pursues, therefore, but in sight; and when he has seized his prey he stoops from his height, as if to examine its weight, always laying it on the ground before he carries it off. As his wing is very powerful, yet, as he has but little suppleness in the joints of the leg, he finds it difficult to rise when down; however, if not instantly pursued, he finds no difficulty in carrying off geese and cranes. He also carries away hares, lambs, and kids; and often destroys fawns and calves, to drink their blood, and carries a part of their flesh to his retreat. Infants themselves, when left unattended, have been destroyed by these rapacious creatures; which probably gave rise to the fable of Ganymede's being snatched up by an eagle to heaven.

An instance is recorded in Scotland of two

children being carried off by eagles; but fortunately they received no hurt by the way; and the eagles being pursued, the children were restored unhurt out of the nests to the affrighted parents.¹

The eagle is thus at all times a formidable neighbour; but peculiarly when bringing up its young. It is then that the female, as well as the male, exert all their force and industry to supply their young. Smith, in his history of Kerry, relates, that a poor man in that country got a comfortable subsistence for his family during a summer of famine, out of an eagle's nest, by robbing the eaglets of food, which was plentifully supplied by the old ones. He protracted their assiduity beyond the usual time, by clipping their wings, and retarding the flight of the young; and very probably also, as I have known myself, by so tying them as to increase their cries, which is always found to increase the parent's despatch to procure them provision. It was lucky, however, that the old eagles did not surprise the countryman as he was thus employed, as their resentment might have been dangerous.

It happened some time ago, in the same country, that a peasant resolved to rob the nest of an eagle, that had built in a small island in the beautiful lake of Killarney. He accordingly stripped, and swam in upon the island while the old ones were away; and, robbing the nest of its young, he was preparing to swim back, with the eaglets tied in a string; but while he was yet up to his chin in the water, the old eagles returned, and, missing their young, quickly fell upon the plunderer, and, in spite of all his resistance, despatched him with their beaks and talons.²

In order to extirpate these pernicious birds, there is a law in the Orkney Islands, which entitles any person that kills an eagle to a hen out of every house in the parish in which the plunderer is killed.

The nest of the eagle is usually built in the most inaccessible cliff of the rock, and often

shielded from the weather by some jutting crag that hangs over it. Sometimes, however, it is wholly exposed to the winds, as well sideways as above; for the nest is flat though built with great labour. It is said that the same nest serves the eagle during life; and indeed the pains bestowed in forming it seems to argue as much. One of these was found in the Peak of Derbyshire; which Willoughby thus describes. "It was made of great sticks, resting one end on the edge of a rock, the other on two birch trees. Upon these was a layer of rushes, and over them a layer of heath, and upon the heath rushes again: upon which lay one young one, and an addle egg; and by them a lamb, a hare, and three heath-poults. The nest was about two yards square, and had no hollow in it. The young eagle was of the shape of a goshawk, of almost the weight of a goose, rough-footed, or feathered down to the foot, having a white ring about the tail." Such is the place where the female eagle deposits her eggs; which seldom exceed two at a time in the larger species, and not above three in the smallest. It is said that she hatches them for thirty days: but frequently, even of this small number of eggs, a part is addled; and it is extremely rare to find three eaglets in the same nest. It is asserted, that as soon as the young ones are somewhat grown, the mother kills the most feeble or the most voracious. If this happens, it must proceed only from the necessities of the parent, who is incapable of providing for their support; and is content to sacrifice a part to the welfare of all.

The plumage of the eaglets is not so strongly marked as when they come to be adult. They are at first white; then inclining to yellow; and at last of a light brown. Age, hunger, long captivity, and diseases, make them whiter. It is said they live above a hundred years; and that they at last die, not of old age, but from the beaks turning inward upon the under mandible, and thus preventing their taking any food. They are equally remarkable, says Mr. Pennant, for their longevity, and for their power of sustaining a long abstinence from food. One of this species, which has now been nine years in the possession of Mr. Owen Holland, of Conway, lived thirty-two years with the gentleman who made him a present of it; but what its age was when the latter received it from Ireland is unknown. The same bird also furnishes a proof of the truth of the other remark; having once, through the neglect of servants, endured hunger for twenty-one days, without any sustenance whatever.

Those eagles which are kept tame, are fed with every kind of flesh, whether fresh or corrupting; and when there is a deficiency of that, bread, or other provision will suffice. It is very dangerous approaching them if not quite tame; and they sometimes send forth a loud piercing lamentable cry, which renders them still more

¹ Ray relates that, in one of the Orkneys, a child of a year old was seized by an eagle, and carried about four miles to its nest. The mother pursued it, found her child in the nest, and took it away unhurt.—Ed.

² A gentleman who lived in the south of Scotland had, not many years ago, a tame eagle, which the keeper one day injudiciously thought proper, for some petty fault, to lash with a horse-whip. About a week afterwards, the man chanced to stoop within reach of his chain, when the enraged animal recollecting the late insult, flew in his face with so much fury and violence, that he was terribly wounded, but was luckily driven so far back by the blow as to be out of all further danger. The screams of the eagle alarmed the family, who found the man lying at some distance in a very bloody condition, equally stunned with the fright and fall. The animal was still pacing and screaming in a manner not less formidable than majestic. It was even dreaded whether, in so violent a rage, he might not break loose; which, indeed, fortunately perhaps for them, he did, just as they withdrew, and thus escaped for ever.—Ed.

formidable. The eagle drinks but seldom; and perhaps, when at liberty, not at all, as the blood of its prey serves to quench its thirst. The eagle's excrements are always soft and moist, and tinged with that whitish substance which, as was said before, mixes in birds with the urine.

Such are the general characteristics and habits of the eagle; however, in some these habits differ, as the sea eagle and the osprey live chiefly upon fish, and consequently build their nests on the shore, and by the sides of rivers on the ground among reeds; and often lay three or four eggs, rather less than those of a hen, of a white elliptical form. They catch their prey, which is chiefly fish, by darting down upon them from above. The Italians compare the violent descent of these birds on their prey to the fall of lead into water; and call them *aquila piombina*, or the leaden eagle.

Nor is the bald eagle, which is an inhabitant of North Carolina, less remarkable for habits peculiar to itself. These birds breed in that country all the year round. When the eaglets are just covered with down, and a sort of white woolly feathers, the female eagle lays again. These eggs are left to be hatched by the warmth of the young ones that continue in the nest; so that the flight of one brood makes room for the next that are but just hatched. These birds fly very heavily; so that they cannot overtake their prey like others of the same denomination. To remedy this, they often attend a sort of fishing-hawk, which they pursue, and strip the plunderer of its prey. This is the more remarkable, as this hawk flies swifter than they. These eagles also generally attend upon fowls in the winter; and when any birds are wounded, they are sure to be seized by the eagle, though they may fly from the fowler. This bird will often also steal young pigs, and carry them alive to the nest, which is composed of twigs, sticks, and rubbish; it is large enough to fill the body of a cart; and is commonly full of bones half eaten, and putrid flesh, the stench of which is intolerable.

The distinctive marks of each species are as follow:

The golden eagle: of a tawny iron colour; the head and neck of a reddish iron; the tail feathers of a dirty white, marked with cross bands of tawny iron; the legs covered with tawny iron feathers.³

The common eagle: of a brown colour; the head and upper part of the neck inclining to red; the tail feathers white, blackening at the ends; the outer ones, on each side, of an ash colour; the legs covered with feathers of a reddish brown.⁴

³ See Supplementary Note A, p. 31.

⁴ The common eagle is found all over Europe and North America. It frequents chiefly in the high mountains of France, Switzerland, Germany, Poland, and Scotland, and descends into the plains in winter. It has been seen in Barbary, and it would appear that it also exists in Arabia and Persia. It has been

The bald eagle: brown; the head, neck, and tail feathers, white; the feathers of the upper part of the leg brown.

The white eagle: the whole white.

The kough-footed eagle: of a dirty brown; spotted under the wings, and on the legs, with white; the feathers of the tail white at the beginning and the point; the leg-feathers dirty brown, spotted with white.

The white-tailed eagle: dirty brown; head white; the stems of the feathers black; the rump inclining to black; the tail feathers, the first half black, the end half white; legs naked.

The erne: a dirty iron colour above, an iron mixed with black below; the head and neck ash, mixed with chestnut; the points of the wings blackish; the tail feathers white; the legs naked.

The black eagle: blackish; the head and upper neck mixed with red; the tail feathers, the first half white, speckled with black; the other half blackish; the leg feathers dirty white.

The sea eagle: inclining to white, mixed with iron brown; belly white with iron-coloured spots; the covert feathers of the tail whitish; the tail feathers black at the extremity; the upper part of the leg feathers of an iron brown.

The osprey: brown above, white below, the back of the head white, the outward tail feathers, on the inner side, streaked with white; legs naked.⁵

found in Louisiana, the Floridas, Carolina, and at Hudson's Bay. During summer, it never quits the mountains, but when it descends in winter the forest becomes its asylum during the rigour of that season. The flight of this eagle is so high, that it is often completely lost sight of. From this great distance, however, its cry is still audible, and then resembles the barking of a small dog. This eagle builds, on the most rugged rocks, a flat nest about five feet square where it rears the young, whose operations it also directs during their adolescence. Its eggs are of a brown red, with blackish stripes. It is particularly fond of hares, which form its principal food. It also preys on various birds, and even on lambs. The male eagle never hunts alone except when the female cannot quit the eggs or young. At other seasons they always hunt together; and some mountaineers pretend that one beats the bushes, while the other remains in some elevated place to stop the prey on its passage. According to Marco Polo, the eagle is employed in Tartary to hunt hares, and even wolves and foxes, but this probably applies to the great eagle: the common eagle was of no use in falconry. Spallanzani has observed, in relation to this bird, that when it swallows pieces of meat, two streams of fluid spring from the apertures of its nostrils, run down the upper part of the beak, and uniting at its point, enter it and mix with the food.—Ed.

⁵ The osprey, or ossifrage, is so named, because fragments of bones of considerable magnitude have been found in its stomach. It is found in the different countries of Europe and North America. Though it appears generally to prefer cold and even frozen regions, such as Russia, Siberia, and Kamtschatka, Poirer has seen it in Barbary. From its usual habitat on the sea-shore, on the banks of great rivers and lakes over which it is continually hovering, it has received the denomination of the great sea-eagle.

The *jean le blanc*: above brownish gray; below, white, spotted with tawny brown; the tail feathers, on the outside and at the extremity, brown; on the inside, white, streaked with brown; legs naked.

The eagle of Brazil: blackish brown; ash colour, mixed in the wings; tail feathers white; legs naked.

The Oronoko eagle: with a topping; above, blackish brown; below, white, spotted with black; upper neck yellow; tail feathers brown, with white circles; leg feathers white, spotted with black.

The crowned African eagle: with a topping; the tail of an ash colour, streaked on the upper side with black.

The eagle of Pondicherry: chestnut colour; the six outward tail feathers black one half.³

Fish is the principal article of its subsistence, which it seizes by darting on it when it is on a level with the water, and sometimes even by plunging after it. It also preys on sea-birds, young seals, hares, and even lambs. It hunts and fishes both by night and day, having the double advantage of seeing better in daylight than the nocturnal birds, and by night than the diurnal. The morning and evening, however, are the principal times which it devotes to this exercise. Its flight is neither as elevated nor as rapid as that of the great eagle, and not being so long-sighted, it does not pursue its prey so far. The osprey builds its nest in the rocks which border the sea-coast, or in very lofty oaks. It lays two round and very heavy eggs of a dirty white. It nurses its young with the greatest affection; but as one of the eggs is often unfruitful, the species, though considerably extended, is not very numerous anywhere.

The pygargus, which is now ascertained to be of the same species as the osprey, though formerly separated, is found in the northern parts of both continents. Pallas beheld a prodigious quantity of them in the mountains of the Volga. This bird frequents the sea-coasts, and lives on fish, young seals, ducks, &c., and the carcasses of animals cast on shore by the waves. It has been observed that the pygargi which frequent inhabited places, hunt only for some hours in the middle of the day, and rest in the morning, evening, and night. This bird builds its nest in rocks, and composes it of small branches arranged in a circular form: the interior is furnished with weeds, grass, moss, and feathers. Buffon informs us, after Willoughby, that this nest is also found on large trees, whose foliage constitutes its only shelter above. The female lays two whitish eggs of the form and size of goose eggs. Incubation takes place in April, and frequently but one young one is hatched. These birds feed their young by throwing pieces of flesh into the nest, which the latter quit as soon as they are able to fly, and accompany the parents to the chase.—Ed.

³ To these may be added, a species of sea eagle, which M. Audubon has called the *Bird of Washington*, as being the noblest of the genus known to naturalists. The flight of this bird is very different from that of the white-headed eagle, encircling more diameter than the latter; whilst sailing, keeping nearer to the land and the surface of the water; and when about to dive for fish, falling in a circuitous spiral manner, as if with an intention of checking all retreating movement which its prey might attempt, and only when within a few yards darting upon it. The fish-hawk often does the same. When rising with a fish they fly to a considerable distance, forming

in their line of course and that of the water a very acute angle, something not exceeding thirty degrees, when several hundred yards distant from the spot emerged from. The male bird weighs about 14½ lbs. avoirdupois, measures 3 ft. 7 in. in length, and 10 ft. 2 in. in extent. The upper mandible 3½ in., dark bluish black.

The Martial eagle, sometimes called the *griffard*, is a large species discovered in Africa by Le Vaillant. It inhabits the country of the great Namaquois, between the twenty-eighth degree of south latitude and the tropic, and probably exists in the other parts of Africa. When perched, it emits sharp and piercing cries, mixed with hoarse and lugubrious tones, which are heard at a great distance. It flies with the legs pendant, and, like the common eagle, rises so high that it is lost sight of, though its cry is still audible. Highly courageous, it never suffers any great bird of rapine to approach within its domain. It hunts gazelles and hares. The griffards, like the other eagles, are usually observed in couples, but during the hatching time the male alone provides for the subsistence of the family. The nest is formed between precipitous rocks; or on the summits of lofty trees. Its basis is constituted like that of the other eagles' nests, but it is covered with a large quantity of small wood, moss, and roots, which give it a thickness of about two feet. This bed is again covered with small bits of dry wood, on which the female lays two eggs almost round, entirely white, and more than three inches in diameter.—Ed.

NOTE A.—The Golden Eagle.

Of the various birds that inhabit this country, perhaps none have attracted more attention than the eagles, of which two species are indigenous. The Golden or Ring-tailed eagle (*Aquila Chrysaetus*), although formerly not uncommon in various parts of Britain, is now chiefly met with in the mountainous districts of the middle and northern divisions of Scotland, and in the larger Hebrides, where the species still maintains a rather precarious existence. Excepting the White-tailed Sea eagle, *Haliaetus Albipectus*, it is the largest of our rapacious birds. As is generally the case among the Raptores, the male is much inferior in size to the female. Several individuals were about two feet nine inches in length, their expanded wings measuring about six feet; the body robust; the neck of moderate length; the head rather large; the wings when closed reaching nearly to the end of the tail, which is rather long, broad, and rounded; the bill is rather short, very deep, compressed with a curved acute tip; and the feet, which are feathered to the lower tarsal joint, are very muscular; the toes strong, united at the base by a short web, and furnished with large, curved, tapering, acute claws, rounded on the sides, and flat beneath; those of the first and second toes being largest. The bill is grayish blue at the base, black at the end, as are the claws; the cere and toes yellow. The general colour of the plumage is dark brown; the hind head and neck light yellowish-brown; the inner and fore sides of the legs and tarsi reddish-brown. The quills are brownish-black, their inner webs irregularly barred with grayish-white; the tail brownish-black towards the end, its proximal part lighter, and irregularly barred or mottled with grayish. The female is generally about three feet two inches in length, with the extended wings measuring about seven feet; the weight varying from ten to twelve pounds. The colours are similar to those of the male, but generally lighter. Young birds have the basal portion of the tail white, that colour being gradually encroached upon by the brown, until the fifth or sixth year, when it entirely disappears.

This beautiful, powerful, and rapacious bird, hav-

ing very frequently come under our observation both in the wild and captive states, we are enabled to present to our readers a somewhat detailed account of its habits. All eagles when at rest have a peculiarly clumsy appearance, owing chiefly to the great size of their wings, which they seem to find it difficult to dispose of in a neat and compact manner; but when roused they assume a bold and lively attitude, rendered more imposing by the glare of their full and bright eyes, which are partially overshadowed by the projecting lachrymal bones or eyebrows. The Golden eagle is more lively than the Sea eagle, and of more destructive habits; for, although a carrion bird, it frequently seizes grouse, hares, and other small animals, and sometimes attacks even deer and sheep. Great havoc is occasionally made by it among the lambs, before they have attained the age of six weeks; and in consequence of the injury thus inflicted, various methods have been employed for reducing its numbers. Sometimes its nest is assailed from above, by letting down a person upon a rope, who generally succeeds in destroying its contents, whether by removing them, or by lowering among them a bundle of combustible matter with a live coal enclosed. The old birds are shot, by being enticed, by means of a dead sheep or horse, to a spot in the immediate vicinity of which a person is concealed under ground, or in a small hut, so covered with heath that it cannot be distinguished from the surrounding surface. More commonly, however, eagles are trapped, at least on the mainland of Scotland.

The flight of the Golden eagle is very beautiful. Owing to the great size of its wings, it finds some difficulty in rising from the ground, although it is considerably more active in this respect than the White-tailed eagle; but when fairly on wing, it proceeds with great ease, and on occasion is capable of urging its speed so as to equal that of most large birds. However, even at its utmost stretch, it is certainly much inferior to that of the rock pigeon, the merlin, and many other species; and the raven, during the breeding season, finds no difficulty in overtaking an eagle that may happen to fly near his nest. When searching the hills for food, it flies low, with a motion of the wings resembling that of the raven, but with occasional sailings and curves, in the manner of many hawks. At times it ascends high into the air, and floats in a circling course over the mountains, until it has discovered some large object; but in tracing grouse and other animals concealed among the herbage, or in hunting for sea-fowls and their young, it does not indulge in those aerial gyrations, which many closet and some field naturalists have supposed to be performed solely for the purpose of enabling it to spy out its prey from afar. In its ordinary flight, it draws its legs close to the body, contracts its neck, and advances by regular flappings of the wings; but when sailing, it extends these organs nearly to their full stretch, curving them at the same time a little upwards at the tips. An eagle sweeping past in this manner is a most imposing object, the more especially if in the vicinity of its rocky haunts, and still more if the observer be groping his way along the face of a crag, anxiously seeking a point or crevice on which to rest his foot.

Both our native eagles sometimes ascend to an immense height in fine weather, and float high over the mountain tops for hours together; but certainly not for the purpose of despoiling the objects beneath, for no person has ever observed their sudden descent from this sublime station. It is a popular notion, countenanced even by many anatomists and others, who ought to know better, that the eagle mounts towards the sun in order to enjoy unrestrained the sight of that glorious luminary. They tell us that its eye is peculiarly fitted for this purpose by having a strong semi-opaque nictitant membrane, by means

of which the rays are blunted; but they forget that the common duck, the domestic fowl, and the sparrow, which are not addicted to astronomical investigation, have eyes organized precisely in the same manner.

On the ground, the Golden eagle, like all others, is extremely awkward; for, owing to its large wings, its great weight, and the form of its toes, which are encumbered with very large curved and pointed claws, it can only walk in a very deliberate manner, or move from place to place by repeated leaps, in performing which it calls in the aid of its wings. Its feet in fact are not adapted for walking; they are most powerful organs of prehension, capable of inflicting mortal injury on any animal not exceeding a sheep in size. It is with them that it deprives its prey of life, and carries it off to its nest or to some convenient place of retreat. With its curved bill it tears off the feathers and hair; separates morsels of the flesh, and even crunches the bones of small animals.

It is seldom that the Golden eagle ventures under any circumstances to attack a human being. A respectable person in Sutherland relates that two sons of a man of the name of Murray, having robbed an eagle's nest, were retreating with the young, when one of the parent birds, having returned, made a most determined attack upon them. Although each had a stick, it was with great difficulty that they at length effected their escape, when almost ready to sink under fatigue. The Rev. Mr. Inglis, Lochlee, has furnished us with a similar anecdote. The farmer of Glenmark, whose name was Miln, had been out one day with his gun, and coming upon an eagle's nest, he made a noise, to start her, and have a shot. She was not at home, however, and so Miln, taking off his shoes, began to ascend gun in hand. When about half way up, and in a very critical situation, the eagle made her appearance, bringing a plentiful supply to the young which she had in her nest. Quick as thought she darted upon the intruder, with a terrific scream. He was clinging to the rock by one hand, with scarcely any footing. Making a desperate effort, however, he reached a ledge, while the eagle was now so close that he could not shoot at her. A lucky thought struck him: he took off his bonnet and threw it at the eagle, which immediately flew after it to the foot of the rock. As she was returning to the attack, finding an opportunity of taking a steady aim, he shot her: and, no doubt glad that he had escaped so imminent a danger, made the best of his way down.

The male and the female keep together all the year round, and very probably remain attached for life; but should one of them be killed in the breeding season, the survivor is not long in repairing his loss. This circumstance is not peculiar to eagles, but has been frequently observed in other birds, more especially those of the crow family. The Golden eagle prepares its nest about the beginning of March, choosing a place for it as nearly inaccessible as possible. Although it is often met with on the maritime cliffs of the Hebrides, yet the species has a greater predilection for inland precipices than the Sea eagle. It is of great size, flat, and formed of sticks, twigs, grass, and other materials. The eggs are generally two, sometimes single, yellowish white, with irregular, pale, purplish dots. The young are fledged about the end of July, and soon after coming abroad, are left to shift for themselves, or are driven off from the haunts of their parents.

The cry of this species is clear and loud, and may be heard in calm weather to the distance of a mile. It resembles the syllable *cleek* or *qweeh*, several times repeated; but although in captivity the bird frequently utters it, in the wild state it is less loquacious. When kept a prisoner it is more ferocious

than the Sea eagle, and can scarcely be trusted even by the person who supplies it with food. The capability of existing under long-continued privation has sometimes been exhibited in a wonderful degree by captive eagles, which have been accidentally neglected for days or even weeks.

Many marvellous tales are told of eagles, and there is scarcely a parish in Scotland, in which, if tradition be correct, they have not carried off a child. According to popular belief, an eagle transported one from the island of Harris to Skye, over a space of about twenty miles; but as even more wonderful events are as firmly believed, no confidence can be reposed in such accounts. Although individuals of the species sometimes appear in various parts of England, it is probable that they seldom or never breed in any district of that country. The species has been extirpated from the south of Scotland, as has very nearly been the case with the Sea eagle; and it is only in the central ranges of the Grampians, or in the wild glens of the northern division, and among the hills of Skye, Rum, Harris, and other islands on the north-west coast, that the ornithologist has much chance of meeting with it. How few of those who have given detailed histories of this bird have ever seen it, but how much more few they who have enjoyed opportunities of studying its manners! A single fact is of course worth more than a volume of idle imaginings; and however much the above account may yield in interest to those of others, it has the merit of being entirely derived from personal observation.

NOTE B.—*The Balbuzard.*

The Balbuzard is pretty generally spread through France, Germany, and most of the countries of Europe from north to south. It is also found in Barbary, Egypt, Louisiana, and even in the island of Pins in the South Sea. The balbuzards of the reeds in Carolina and Cayenne, appear to be only varieties of the same species, which equally inhabits Pennsylvania, and is sometimes called *piravera*. The places which the balbuzard prefers to frequent, are not the shores of the sea, but low lands bordering on ponds and rivers, from which habit it might be termed the fresh-water eagle. Perched on a lofty tree, or hovering at a considerable elevation in the air, it watches the fish from afar, descends upon it with the rapidity of lightning, seizes it at the moment it appears on the surface of the water, or even plunges in completely after it, and carries it off in its talons. But this prey, the weight of which renders the flight of the bird slow and laborious, does not always remain the portion of the balbuzard. On the banks of the Ohio, where it goes to fish, when the *Perea ocellata* quits the ocean to enter the river, dwells also the formidable pygargus. When he sees the balbuzard arrived to the height of his eyrie, he quits his own, pursues him closely, until the fisher, convinced of his inferiority, abandons the prey; then this fierce antagonist with folded wings shoots down like an arrow, and with the most inconceivable address, seizes the fish again before it reaches the river. The right of the strongest is the sovereign arbiter of small and great events, and governs throughout the universe with resistless sway, in the air, on the earth, and under the waters.

But as a corsair, whose booty has been taken by an enemy in sight of port, undertakes a new expedition in the hope of being more fortunate, so the balbuzard recommences his operations, and possessed of a fresh prey, he usually succeeds, if it be not too heavy, in escaping with it from his redoubtable foe. These scenes continually occur as long as the fish above-mentioned remains in the river. When it returns to the ocean, the pygargus retires to his moun-

tains, to pursue game, and the balbuzard betakes himself to the sea-shore, where he is no longer obliged to pay tribute for his plunder.

The balbuzard builds its nest on the lofty trees of thick forests, or in the crevices of rocks. According to Lewin, it is also constructed on the ground in the midst of reeds. Two or three white eggs are generally laid, sometimes four, and spotted with red. These birds are almost always in pairs; but when the waters are frozen, they separate in search of milder climates and a more facile substance; they are usually very fat, and the flesh savours strongly of fish. It is said, that they might easily be trained for fishing as other birds are for hunting, and it appears not improbable. In Siberia, where they are very common, an opinion prevails that they carry a mortal poison in their talons, and the superstitious inhabitants are dreadfully afraid of a single scratch.—See '*The Animal Kingdom of Baron Cuvier. With Additional Descriptions.*' Vol. VI. London, 1829.

CHAP. III.

THE CONDOR OF AMERICA.

WE might now come to speak of the vulture kind, as they hold the next rank to the eagle; but we are interrupted in our method by the consideration of an enormous bird, whose place is not yet ascertained; as naturalists are in doubt whether to refer it to the eagle tribe, or to that of the vulture. Its great strength, force, and vivacity, might plead for its place among the former; the baldness of its head and neck might be thought to degrade it among the latter. In this uncertainty, it will be enough to describe the bird by the lights we have, and leave future historians to settle its rank in the feathered creation. Indeed, if size and strength, combined with rapidity of flight and rapacity, deserve pre-eminence, no bird can be put in competition with it.

The condor possesses, in a higher degree than the eagle, all the qualities that render it formidable, not only to the feathered kind, but to beasts, and even to man himself. Acosta, Garcilasso, and Desmarchais, assert, that it is eighteen feet across, the wings extended. The beak is so strong as to pierce the body of a cow; and two of them are able to devour it. They do not even abstain from man himself: but fortunately there are but few of the species; for if they had been plenty, every order of animals must have carried on an unsuccessful war against them. The Indians assert, that they will carry off a deer, or a young calf, in their talons, as eagles would a hare or a rabbit; that their sight is piercing and their air terrible; that they seldom frequent the forests, as they require a large space for the display of their wings; but that they are found on the sea-shore, and the banks of rivers, whither they descend from the heights of the mountains. By later accounts we learn, that they come down to the sea-shore only at certain seasons, when

their prey happens to fail them upon land; that they then feed upon dead fish, and such other nutritious substances as the sea throws upon the shore. We are assured, however, that their countenance is not so terrible as the old writers have represented it; but that they appear of a milder nature than either the eagle or the vulture.

Condamine has frequently seen them in several parts of the mountains of Quito, and observed them hovering over a flock of sheep; and he thinks they would, at a certain time, have attempted to carry one off, had they not been scared away by the shepherds. Labat acquaints us, that those who have seen this animal, declare that the body is as large as that of a sheep; and that the flesh is tough, and as disagreeable as carrion. The Spaniards themselves seem to dread its depredations; and there have been many instances of its carrying off their children.

Mr. Strong, the master of a ship, as he was sailing along the coasts of Chili, in the thirty-third degree of south latitude, observed a bird sitting upon a high cliff near the shore, which some of the ship's company shot with a leaden bullet and killed. They were greatly surprised when they beheld its magnitude; for when the wings were extended, they measured thirteen feet from one tip to the other. One of the quills was two feet four inches long: and the barrel or hollow part was six inches and three quarters, and an inch and a half in circumference.

We have a still more circumstantial account of this amazing bird, by P. Feuille, the only traveller who has accurately described it: "In the valley of Ilo, in Peru, I discovered a condor perched on a high rock before me: I approached within gunshot, and fired; but as my piece was only charged with swan-shot, the lead was not able sufficiently to pierce the bird's feathers. I perceived however, by its manner of flying, that it was wounded; and it was with a good deal of difficulty that it flew to another rock, about five hundred yards distant on the sea-shore. I therefore charged again with ball, and hit the bird under the throat, which made it mine. I accordingly ran up to seize it; but even in death it was terrible, and defended itself upon its back with its claws extended against me, so that I scarcely knew how to lay hold of it. Had it not been mortally wounded, I should have found it no easy matter to take it; but I at last dragged it down from the rock, and with the assistance of one of the seamen I carried it to my tent to make a coloured drawing.

"The wings of this bird, which I measured very exactly, were twelve feet three inches (English) from tip to tip. The great feathers, that were of a beautiful shining black, were two feet four inches long. The thickness of the beak was proportionable to the rest of the body; the length four inches; the point hooked downwards, and white at its extremity; the other part was

of a jet black. A short down of a brown colour covered the head; the eyes were black, and surrounded with a circle of reddish brown. The feathers on the breast, neck, and wings, were of a light brown; those on the back were rather darker. Its thighs were covered with brown feathers to the knee. The thigh-bone was ten inches long; the leg five inches; the toes were three before and one behind; that behind was an inch and a half; and the claw with which it was armed was black, and three-quarters of an inch. The other claws were in the same proportion; and the legs were covered with black scales, as also the toes; but in these the scales were larger.

"These birds usually keep in the mountains, where they find their prey: they never descend to the sea-shore but in the rainy season; for, as they are very sensible of cold, they go there for greater warmth. Though these mountains are situated in the torrid zone, the cold is often very severe; for a great part of the year they are covered with snow, but particularly in winter.

"The little nourishment which these birds find on the sea-coast, except when the tempest drives in some great fish, obliges the condor to continue there but a short time. They usually come to the coast at the approach of evening, stay there all night, and fly back in the morning."

It is doubted whether this animal be proper to America only, or whether it may not have been described by the naturalists of other countries. It is supposed that the great bird called the Rock, described by Arabian writers, and so much exaggerated by fable, is but a species of the condor. The great bird of Tarnassar, in the East Indies, that is larger than the eagle, as well as the vulture of Senegal, that carries off children, are probably no other than the bird we have been describing. Russia, Lapland, and even Switzerland and Germany, are said to have known this animal. A bird of this kind was shot in France, that weighed eighteen pounds, and was said to be eighteen feet across the wings; however, one of the quills was described only as being larger than that of a swan; so that probably the breadth of the wings may have been exaggerated, since a bird so large would have the quills more than twice as big as those of a swan. However this be, we are not to regret that it is scarcely ever seen in Europe, as it appears to be one of the most formidable enemies of mankind. In the deserts of Pachomac, where it is chiefly seen, men seldom venture to travel. Those wild regions are very sufficient of themselves to inspire a secret horror: broken precipices—prowling panthers—forests only vocal with the hissing of serpents—and mountains rendered still more terrible by the condor, the only bird that ventures to make its residence in those deserted situations.

SUPPLEMENTARY NOTE.

It is astonishing, observes Humboldt, that one of the largest of terrestrial birds and animals inhabiting countries which Europeans have been accustomed to visit for more than three centuries, should have so long remained so imperfectly known. The descriptions even of the most modern naturalists and travellers concerning this bird are replete with contradiction, error, and falsehood. By some, the size and ferocity of the condor have been immeasurably exaggerated; others have confounded it with approximating species, or assumed the differences observed in the bird from infancy to age, as the diagnostic characteristics of sex. Baron Cuvier, in speaking of the form of the condor, after a careful investigation of all that has been written on the subject before Humboldt, expresses himself thus: "Some authors attribute to the condor a brown plumage, and a head clothed with down; others, a fleshy crest on the forehead, and a black and white plumage. It has not yet been described with any precision." Of the two drawings given by Dr. Shaw, the second alone bears the least resemblance to the great vulture of the Andes. "But the head," says Humboldt, "is without character. It more resembles that of a cock, than the head of the Peruvian condor: Buffon has not even risked an engraving of this bird. The one added to the edition of his works, at Deux Points, is below all criticism."

Baron Humboldt having resided for seventeen months in the native mountains of the condor, and having had occasion constantly to see it in its frequent excursions beyond the limits of perpetual snow, has been enabled to render essential service to zoology by publishing a detailed description of this animal, and the drawings which he sketched of it on the spot. The name condor is derived from the Quichua language, the general language of the ancient Incas. It should be written *cuntur*. Europeans, by a corrupt pronunciation, change the Peruvian *u* and *t*; as they change the syllable *hua* into *gua*. They say, for instance, the volcano of Tonguragua, instead of *Tungurachua*; and Andes, instead of *Anti*. Humboldt thinks, that *cuntur* is derived from *cunturi*, which signifies to smell well, to spread an odour of fruit, meat, or other aliments. The baron observes, that, as there is nothing more astonishing than the almost inconceivable sagacity with which the condor distinguishes the odour of flesh from an immense distance, the etymologist may be allowed to believe, that both *cuntur* and *cunturi* come from one and the same unknown root. He has chosen, however, to retain the popular name of condor.

The young condor has no feathers. The body, for many months, is covered only with a very fine down, or a frizzled whitish hair, resembling that of the young uluhe. This down disfigures the young bird so much, that it appears almost as large in this state as when adult. The condor at two years old has not the black plumage, but a fawn-coloured brown. The female, up to this period, has not the white collar formed at the bottom of the neck by feathers longer than the others. This collar the Spaniards name *golita*. From a want of proper attention to these changes produced by age, many naturalists, and even the inhabitants of Peru themselves, who take little interest in ornithology, have announced two species of condors, black and brown (*condor negroy*, *condor pardo*). Humboldt met persons, even in the city of Quito, who assured him, that the female of the condor is distinguished from the male not only by the absence of the nasal crest, but also by the want of the collar. Gmelin and the Abbe Molina make the same assertion. It is, however, quite certain, that such is not the fact. At

Riobambo, in the environs of Chimborazo and Antisana, the hunters are thoroughly acquainted with the influence produced by age on the form and colour of the condor; and for the most exact notions concerning those varieties we are indebted to them.

The beak of the condor is straight in the upper part, but extremely crooked at the extremity. The lower jaw is much shorter than the upper. The fore-part of this enormous beak is white, the rest of a grayish brown, and not black, as stated by Linnæus. The head and neck are naked, and covered with a hard, dry, and wrinkled skin; this same skin is reddish, but furnished here and there with brown or blackish hairs, short and very stiff. The cranium is singularly flat at the summit; as is the case with all very ferocious animals. The fleshy or rather cartilaginous crest of the condor occupies the summit of the head, and one-fourth of the length of the beak. This crest is entirely wanting in the female, and M. Daudin has erroneously attributed it to her. It is of an oblong figure, wrinkled, and very slender. The ear of the condor exhibits a very considerable aperture; but it is concealed under the folds of the temporal membrane. The eye is singularly elongated, more remote from the beak than in the eagles; very lively, and of a purple colour. The entire neck is garnished with parallel wrinkles; but the skin is less flaccid than that which covers the throat. These wrinkles are placed longitudinally; and arise from the habit of this vulture of contracting its neck, and concealing it in the collar, which answers the purpose of a hood. This collar, which is neither less broad, nor less white in the adult female than in the male, is formed of a fine silken down. It is a white band, which separates from the naked part of the neck the body of the bird furnished with genuine feathers. In both sexes, the hood is not entire; it does not close exactly in front, and the neck is naked as far as the place where the black feathers commence. The rest of the bird, back, wings, and tail, are of a black slightly grayish. The plumes are sometimes of a brilliant black; most frequently, however, the black borders on a gray. They are of a triangular figure, and cover each other mutually, like tiles. The feet are very robust, and of an ashen blue, ornamented with white wrinkles; the talons are of a blackish colour; they are not much crooked, but remarkably long. The four toes are united by a very flaccid, but very perceptible membrane. The fourth toe is very small, and its talon is most curved.

M. de Humboldt has seen no condor, the envergure of which—or measurement of wing from tip to tip—exceeded nine feet French measure. Many persons in Quito and the Andes, worthy of the highest credit, assured M. de Humboldt, that they never killed any that exceeded eleven feet in the envergure. Even on a careful examination of the narratives of travellers, who visited these regions previously to M. de Humboldt, it will appear that, among the naturalists who have measured the vulture of the Andes, there are but few who assign to it a very extraordinary size. From every authentic account of the dimensions of the condor, it appears that this bird is not larger than the *Vultur barbatus*, or læmmer-geyer, which inhabits the central chain of the mountains of Europe, and with which both Buffon and Molina have confounded it. It has been with the condor as with Patagonians and so many other objects of descriptive natural history,—the more they have been examined, the more have their enormous dimensions been found to diminish. The average length of the condors, from the point of the beak to the end of the tail, is but three feet three inches. Their usual envergure eight or nine feet. Some individuals from a superabundant supply of aliment or other causes, may have attained an extent of wings of fourteen feet.

The condor, like the llama, the vicuña, the alpaca, and several alpine plants, is peculiar to the chain of the Andes. The region of the globe which he appears to prefer to every other is of an elevation of from 1,600 to 2,500 toises. Whenever the baron, and his friend, M. Bonpland, were led, in the course of their herborizing excursions, to the limits of perpetual snows, they were always surrounded by condors. There they used to find them, three or four in number, on the points of the rocks. They exhibited no distrust, and suffered themselves to be approached within a couple of toises. They did not appear to have the slightest inclination to attack. Baron de Humboldt declares that, after the utmost research, he never heard a single example quoted of a condor having carried off a child, as has been so frequently reported. M. de Humboldt does not, however, doubt that two condors would be capable of depriving a child of ten years of age of life, or even a grown man. It is very common to see them attack a young bull, and tear out his tongue and eyes. The beak and talons of the condor are of enormous force. Nevertheless all the Indians who inhabit the Andes of Quito are unanimous that this bird is not dangerous to man.

Though the condor exclusively belongs to the chain of the Andes: though it prefers situations more elevated than the Peak of Teneriffe or the summits of Mont-Blanc; though of all animals, it is the one which removes to the greatest distance from the surface of our planet; it is yet not less true, that hunger will sometimes induce it to descend into the plains, and more especially into those which border on this mighty mountain chain. Condors are to be seen even on the shores of the southern ocean, especially in the cold and temperate latitudes of Chili, where the chain of the Andes may be almost said to border on the margin of the Pacific. Still it is observed that this bird sojourns but a few hours in these lower regions. It prefers the mountain solitudes, where it respires a rarefied atmosphere, in which the barometer does not rise above 16. On this account, in the Andes of Peru and Quito, many small groupes of rocks, and platforms elevated 2,450 toises above the level of the sea, bear the names of *Cuntur-Kahua*, *Cuntur-Palti*, *Cuntur-Huachana*, names signifying, in the Inca language, the watch-tower, brooding place, or nest of the condors. Humboldt was assured that the condor builds no nest; that it deposits its eggs on the naked rock, without surrounding them with straw or leaves. The eggs are said to be altogether white, and from three to four inches in length. It is also reported that the female remains with the little ones for the space of an entire year. When the condor descends into the plains, it prefers alighting on the ground to perching in the trees, like the *Vultur aura*. The talons of the condor are very straight; and it is a remark of Aristotle, that birds of prey with very crooked talons are not fond of settling upon stones or rocks.

The habits of the condor are similar to those of the *læmmer-geyer*. If it is not larger than the latter, it appears to be superior in strength and audacity. Two condors will dart upon the deer of the Andes, upon the puma, the vicuña, and the guanaco. They will even attack a heifer. They pursue it for a long time, wounding it with their beak and talons, until the animal, breathless and overwhelmed with fatigue, thrusts out its tongue bellowing. The condor then seizes the tongue, a morsel to which it is much attached. It also tears out the eyes of its victim, which sinks to the earth, and slowly expires. In the province of Quito, the mischief done to cattle, but more especially to sheep and cows by this formidable bird, is immense. In the savannahs of Antisana, 2,101 toises above the level of the sea, bulls are constantly found which have been wounded in the back by condors.

The condor appears to have more tenacity of life than any other bird of prey. M. de Humboldt was present at certain experiments on the life of a condor at Riobamba. They first attempted to strangle it with a noose. They hung it to a tree, and dragged the legs with great force for many minutes: but scarcely was the noose removed, than the condor began to walk about as if nothing had been the matter. Three pistol-balls were then discharged at him within less than four paces distance. They all entered the body. He was wounded in the neck, chest, and belly, but still remained on his feet. A fifth ball struck against the femur, and rebounding, fell on the ground. The condor did not die for half-an-hour after of the numerous wounds which it had received. Ulloa informs us, that in the cold region of Peru the condor is closely furnished with feathers, that eight or ten balls may strike against his body without one piercing it.

It is worthy of observation that the condor prefers carcasses to living animals. It subsists, however, on both, and seems to pursue small birds less than quadrupeds.

CHAP. IV.

OF THE VULTURE AND ITS AFFINITIES.

THE first rank in the description of birds has been given to the eagle; not because it is stronger or larger than the vulture, but because it is more generous and bold. The eagle, unless pressed by famine, will not stoop to carrion; and never devours but what he has earned by his own pursuit. The vulture, on the contrary, is indelicately voracious; and seldom attacks living animals when it can be supplied with the dead. The eagle meets and singly opposes his enemy; the vulture, if it expects resistance, calls in the aid of its kind, and basely overpowers its prey by a cowardly combination. Putrefaction and stench, instead of deterring, only serves to allure them. The vulture seems among birds what the jackal and hyæna are among quadrupeds, who prey upon carcasses, and root up the dead.

Vultures may be easily distinguished from all those of the eagle kind by the nakedness of their heads and necks, which are without feathers, and only covered with a very slight down, or a few scattered hairs. Their eyes are more prominent; those of the eagle being buried more in the socket. Their claws are shorter, and less hooked. The inside of the wing is covered with a thick down, which is different in them from all other birds of prey. Their attitude is not so upright as that of the eagle; and their flight more difficult and heavy.

In this tribe we may range the golden, the ash-coloured, and the brown vulture, which are inhabitants of Europe; the spotted and the black vulture of Egypt; the bearded vulture; the Brazilian vulture, and the king of the vultures, of South America. They all agree in their nature:

being equally indolent, yet rapacious and unclean.

The Golden vulture seems to be the foremost of the kind; and is, in many things, like the golden eagle, but larger in every proportion. From the end of the beak to that of the tail, it is four feet and a half; and to the claws' end, forty-five inches. The length of the upper mandible is almost seven inches; and the tail twenty-seven in length. The lower part of the neck, breast, and belly, are of a red colour; but on the tail it is more faint, and deeper near the head. The feathers are black on the back, and on the wings and tail of a yellowish brown. Others of the kind differ from this in colour and dimensions; but they are all strongly marked by their naked heads, and beak straight in the beginning, but hooking at the point.

They are still more strongly marked by their nature, which, as has been observed, is cruel, unclean, and indolent. Their sense of smelling, however, is amazingly great; and Nature, for this purpose, has given them two large apertures or nostrils without, and an extensive olfactory membrane within.¹ Their intestines are formed differently from those of the eagle kind; for they partake more of the formation of such birds as live upon grain. They have both a crop and a stomach; which may be regarded as a kind of gizzard, from the extreme thickness of the muscles of which it is composed. In fact, they seem adapted inwardly, not only for being carnivorous, but to eat corn, or whatsoever of that kind comes in the way.

This bird, which is common in many parts of

¹ It is now thought by many naturalists, that it is the eye, and not the scent, which leads birds to their prey. The toucan is a bird which ranks next to the vulture in discerning, whether by smell or sight, the carrion on which it feeds. The immense size of its bill, which is many times larger than its head, was supposed to present in its honeycomb texture an extensive prolongation of the olfactory nerve, and thus to account for its smelling at great distances; but on accurate examination, the texture above mentioned in the bill is found to be mere diploe, to give the bill strength. Now the eye of this bird is somewhat larger than the whole brain; and it has been ascertained by direct experiments, that where very putrid carrion was enclosed in a basket from which effluvia could freely emanate, but which concealed the offal from sight, it attracted no attention from vultures and other birds of prey till it was exposed to their view, when they immediately recognised their object, and others came rapidly from different quarters of the horizon where they were invisible a few minutes before. This sudden appearance of birds of prey from immense distances and in every direction, however the wind may blow, is accounted for by their soaring to an altitude. In this situation, their prey on the ground is seen by them, however minute it may be; and therefore their appearance in our sight is merely their descent from high regions to within the scope of our optics. Waterton, however, no ordinary authority on such points, stoutly contends that "all vultures can find their food through the medium of their olfactory nerves, though it be imperceptible to their eye."—Ed.

Europe, and but too well known on the western continent, is totally unknown in England. In Egypt, Arabia, and many other kingdoms of Africa and Asia, vultures are found in great abundance. The inside down of their wing is converted into a very warm and comfortable kind of fur, and is commonly sold in the Asiatic markets.

Indeed, in Egypt this bird seems to be of singular service. There are great flocks of them in the neighbourhood of Grand Cairo, which no person is permitted to destroy. The service they render the inhabitants is the devouring of all the carrion and filth of that great city; which might otherwise tend to corrupt and putrefy the air. They are commonly seen in company with the wild dogs of the country, tearing a carcass very deliberately together. This odd association produces no quarrels; the birds and quadrupeds seem to live amicably, and nothing but harmony subsists between them. The wonder is still the greater, as both are extremely rapacious, and both lean and bony to a very great degree; probably having no great plenty even of the wretched food on which they subsist.

In America they lead a life somewhat similar. Wherever the hunters, who there only pursue beasts for the skins, are found to go, these birds are seen to pursue them. They still keep hovering at a little distance; and when they see the beast flayed and abandoned, they call out to each other, pour down upon the carcass, and in an instant pick its bones as bare and clean as if they had been scraped by a knife.

At the Cape of Good Hope, in Africa, they seem to discover a still greater share of dexterity in their methods of carving. "I have," says Kolben, "been often a spectator of the manner in which they have anatomized a dead body: I say anatomized; for no artist in the world could have done it more cleanly. They have a wonderful method of separating the flesh from the bones, and yet leaving the skin quite entire. Upon coming near the carcass, one would not suppose it thus deprived of its internal substance, till he began to examine it more closely; he then finds it, literally speaking, nothing but skin and bone. Their manner of performing the operation is this: they first make an opening in the belly of the animal, from whence they pluck out, and greedily devour, the entrails: then entering into the hollow which they have made, they separate the flesh from the bones, without ever touching the skin. It often happens that an ox returning home alone to its stall from the plough, lies down by the way: it is then, if the vultures perceive it, that they fall with fury down, and inevitably devour the unfortunate animal. They sometimes attempt them grazing in the fields; and then, to the number of a hundred or more, make their attack all at once and together."

"They are attracted by carrion," says Catesby, "from a very great distance. It is pleasant to

behold them, when they are thus eating and disputing for their prey. An eagle generally presides at these entertainments, and makes them all keep their distance till he has done. They then fall to with an excellent appetite; and their sense of smelling is so exquisite, that the instant a carcass drops, we may see the vultures floating in the air from all quarters, and come sousing on their prey." It is supposed by some, that they eat nothing that has life; but this is only when they are not able; for when they come at lambs, they show no mercy; and serpents are their ordinary food. The manner of those birds is to perch themselves, several together, on the old pine and cypress trees; where they continue all the morning, for several hours, with their wings unfolded: nor are they fearful of danger, but suffer people to approach them very near, particularly when they are eating.

The sloth, the filth, and the voraciousness, of these birds, almost exceed credibility. In the Brazils, where they are found in great abundance, when they light upon a carcass, which they have liberty to tear at their ease, they so gorge themselves that they are unable to fly; but keep hopping along when they are pursued. At all times they are a bird of slow flight, and unable readily to raise themselves from the ground; but when they have over-fed, they are then utterly helpless: but they soon get rid of their burden; for they have a method of vomiting up what they have eaten, and then they fly off with greater facility.

It is pleasant, however, to be a spectator of the hostilities between animals that are thus hateful or noxious. Of all creatures, the two most at enmity is the vulture of Brazil and the crocodile. The female of this terrible amphibious creature, which in the rivers of that part of the world grows to the size of twenty-seven feet, lays its eggs, to the number of one or two hundred, in the sands, on the side of the river, where they are hatched by the heat of the climate. For this purpose she takes every precaution to hide from all other animals the place where she deposits her burden: in the meantime a number of vultures, or galinassos, as the Spaniards call them, sit silent and unseen in the branches of some neighbouring forest, and view the crocodile's operations, with the pleasing expectation of succeeding plunder. They patiently wait till the crocodile has laid the whole number of her eggs, till she has carefully covered them under the sand, and until she has retired from them to a convenient distance. Then, all together, encouraging each other with cries, they pour down upon the nest, hook up the sand in a moment, lay the eggs bare, and devour the whole brood without remorse. Wretched as is the flesh of these animals, yet men, perhaps when pressed by hunger, have been tempted to taste it. Nothing can be more lean, stringy, nauseous, and unsavoury. It is in vain that, when killed, the rump has been

cut off; in vain the body has been washed, and spices used to overpower its prevailing odour; it still smells and tastes of the carrion by which it was nourished, and sends forth a stench that is insupportable.

These birds, at least those of Europe, usually lay two eggs at a time, and produce but once a-year. They make their nests in inaccessible cliffs, and in places so remote that it is rare to find them. Those in our part of the world chiefly reside in the places where they breed, and seldom come down into the plains, except when the snow and ice, in their native retreats, have banished all living animals but themselves: they then come from their heights, and brave the perils they must encounter in a more cultivated region. As carrion is not found at those seasons in sufficient quantity, or sufficiently remote from man, to sustain them, they prey upon rabbits, hares, serpents, and whatever small game they can overtake or overpower.

Such are the manners of this bird in general; but there is one of the kind, called the king of the vultures, which from its extraordinary figure deserves a separate description. This bird is a native of America, and not of the East Indies, as those who make a trade of showing birds would induce us to believe. This bird is larger than a turkey-cock; but is chiefly remarkable for the odd formation of the skin of the head and neck, which is bare. This skin arises from the base of the bill, and is of an orange colour; from whence it stretches on each side to the head; from thence it proceeds, like an indented comb, and falls on either side, according to the motion of the head. The eyes are surrounded by a red skin, of a scarlet colour; and the iris has the colour and lustre of pearl. The head and neck are without feathers, covered with a flesh-coloured skin on the upper part, a fine scarlet behind the head, and a dusky-coloured skin before: farther down, behind the head, arises a little tuft of black down, from whence issues and extends beneath the throat, on each side, a wrinkled skin, of a brownish colour, mixed with blue, and reddish behind: below, upon the naked part of the neck, is a collar formed by soft longish feathers, of a deep ash-colour, which surround the neck, and cover the breast before. Into this collar the bird sometimes withdraws its whole neck, and sometimes a part of the head, so that it looks as if it had withdrawn the neck into the body. Those marks are sufficient to distinguish this bird from all others of the vulture kind; and it cannot be doubted but that it is the most beautiful of all this deformed family; however, neither its habits nor instincts vary from the rest of the tribe; being, like them, a slow cowardly bird, living chiefly upon rats, lizards, and serpents; and upon carrion or excrement, when it happens to be in the way. The flesh is so bad, that even savages themselves cannot abide it.

SUPPLEMENTARY NOTE.

It would be idle to notice all the species of vultures which have been enumerated by naturalists. To do so would, in fact, be to dwell for the most part on a series of names, which have been constantly applied to the same species seen under different modifications. M. Vieillot remarks, that, after having observed the living vultures under the various metamorphoses which the difference of age occasions in their plumage, and having most attentively studied the subject, he is fully convinced that few of their genera are composed of as many species as some naturalists have adopted without examination, and others have repeated without reflection. Brisson, Gmelin, and Latham have described seven or eight species of vultures in Europe, though it appears more than probable that there are but three or four.

Of all the characters drawn from the anterior portion of the body in the vulture tribe, the most distinct is the greater or less degree of nudity of the head and neck. To this may be added, that they differ from the eagles with which they have been vulgarly confounded, by having their eyes on a level with the head, while the eyes of the others are sunk within their orbits. They differ also in their discovered ears, in the form of their claws, (those of the eagle, properly so called, being almost semicircular,) and in the tarsi, which, in the known species, are totally naked. Besides these characters, which are merely methodical, there are others of a more prominent kind which cannot lead into error, nor permit the confusion of the genuine vultures with any of the other birds of prey. Their port is inclined, half horizontal, a position indicating their grovelling nature; whereas the eagle stands proudly upright and almost perpendicular on its feet. On the ground, to which, by the way, they are much attached, their wings are pendant, and their tail trailed along. Accordingly, we find the end of the penfeathers constantly worn. Their flight is heavy, and they experience considerable difficulty in taking their full soar. Finally, they are the only birds of prey that fly and live gregariously.

Their mode of life, disposition, and habits, exhibit characters still more marked. The vultures are cowardly, disgusting, gormandizing in the extreme, voracious, and cruel. They rarely attack living animals, but when they can no longer satiate themselves on dead bodies. They attack a single enemy with numbers, and tear carcasses even to the very bone. They are attracted by the savour of corruption and infection. The hawks, the falcons, and even the smallest birds of this order, exhibit more courage than the vultures; for they hunt their prey alone, almost all of them disdain dead flesh, and will reject that which is corrupted. Comparing birds with quadrupeds, the vulture appears to unite the strength and cruelty of the tiger with the cowardice and gormandism of the chacal, which likewise joins in troops to devour carrion and root up the dead: while the eagle has the courage, nobleness, magnanimity, and generosity of the lion. Endowed either with a sense of smelling extremely keen, or an exquisitely keen sight, any prey attracts vultures from a considerable distance. They fly towards it in flocks, and all the species are admitted indiscriminately to the banquet. If pressed by hunger, they will descend near the habitations of men, but they never attempt an attack except on the peaceable and timid tenants of the poultry yard.

The vultures are more numerous in the southern than in the northern parts of the globe. Still, it does not appear that they dread the cold, and seek warmth in preference; for in our part of the world they live in the greatest numbers on the highest

mountains, and descend but rarely into the plains. In the hot climates, such as Egypt, where they are very numerous and of great utility, because they clear the surface of the earth of the debris of dead animals, and prevent the ill consequences of putrefaction, they are more frequently seen upon the plain than in the mountains. They approach inhabited places, and spread themselves at day-break in the towns and villages, and render essential service to the inhabitants by gorging themselves with the filth and carrion accumulated in the streets. In our climates the vultures during the fine season inhabit the most lofty and deserted mountains: there, says Belon, they build their nests against shelvy rocks and in inaccessible situations. Authors are not agreed as to the number of their eggs, some stating it at two, others more. They do not carry food for their young in their talons, like the eagles, which even tear their prey in the air to distribute to their family; but they fill their crop, and then disgorge the contents into the beaks of the little ones. In winter they migrate into a warmer climate.

Bruce gives the following striking account of a predatory bird, which we apprehend must have been one of the vultures, although his description of the size would lead us to suppose it to be the condor. But as this bird has never been met with in Africa, we must suppose it some other species.

"This noble bird," says this celebrated traveller, "was not an object of any chase or pursuit, nor stood in need of any stratagem to bring him within our reach. Upon the highest top of the mountain Lamalmon, while my servants were refreshing themselves from that toilsome, rugged ascent, and enjoying the pleasure of a most delightful climate, eating their dinner in the outer air, with several large dishes of boiled goat's flesh before them, this enemy, as he turned out to be to them, suddenly appeared; he did not stoop rapidly from a height, but came flying slowly along the ground, and sat down close to the meat, within the ring the men had made round it. A great shout, or rather cry of distress, called me to the place. I saw the eagle stand for a minute, as if to recollect himself; while the servants ran for their lances and shields. I walked up as nearly to him as I had time to do. His attention was fully fixed upon the flesh. I saw him put his foot into the pan, where was a large piece in water prepared for boiling; but finding the smart, which he had not expected, he withdrew it, and forsook the piece that he held.

"There were two large pieces, a leg and a shoulder, lying upon a wooden platter; into these he thrust both his claws, and carried them off; but I thought he still looked wistfully at the large piece which remained in the warm water. Away he went slowly along the ground, as he had come. The face of the cliff over which criminals were thrown, took him from our sight. The Mahometans that drove the asses, were much alarmed, and assured me of his return. My servants, on the other hand, very unwillingly expected him, and thought he had already more than his share.

"As I had myself a desire of a more intimate acquaintance with him, I loaded a rifle-gun with ball, and sat down close to the platter by the meat. It was not many minutes before he came, and a prodigious shout was raised by my attendants, 'He is coming, he is coming,' enough to have dismayed a less courageous animal. Whether he was not quite so hungry as at his first visit, or suspecting something from my appearance, I knew not, but he made a small turn, and sat down about ten yards from me, the pan with the meat being between me and him. As the field was clear before me, and I did not know but his next move might bring him opposite to some of my people, so that he might actually get

the rest of the meat, and make off, I shot him with the ball through the middle of the body, about two inches below the wings, so that he lay down upon the grass without a single flutter.

"Upon laying hold of his monstrous carcass, I was not a little surprised at seeing my hands covered and tinged with yellow powder or dust. On turning him upon his belly, and examining the feathers of his back, they also produced a dust, the colour of the feathers there. This dust was not in small quantities; for, upon striking the breast, the yellow powder flew in far greater quantity than from a hair-dresser's powder-puff. The feathers of the belly and breast, which were of a gold colour, did not appear to have any thing extraordinary in their formation; but the large feathers in the shoulder and wings seemed apparently to be fine tubes, which, upon pressure, scatter their dust upon the finer parts of the feather; but this was brown, the colour of the feathers of the back. Upon the side of the wing the ribs, or hard part of the feathers, seemed to be bare, as if worn; or, I rather think, were renewing themselves, having before failed in their functions. What is the reason of this extraordinary provision of nature, is not in my power to determine. As it is an unusual one, it is probably meant for a defence against the climate, in favour of the birds which live in those almost inaccessible heights of country, doomed, even in its lower parts, to several months excessive rain."

CHAP. V.

OF THE FALCON KIND, AND ITS AFFINITIES.

EVERY creature becomes more important in the history of nature in proportion as it is connected with man. In this view, the smallest vegetable, or the most seemingly contemptible insect, is a subject more deserving attention than the most flourishing tree, or the most beautiful of the feathered creation. In this view, the falcon is a more important animal than the eagle or the vulture; and though so very diminutive in the comparison, is notwithstanding, from its connexion with our pleasures, a much more interesting object of our curiosity.

The amusement of hawking, indeed, is now pretty much given over in this kingdom; for as every country refines, as its enclosures become higher and closer, those rural sports must consequently decline, in which the game is to be pursued over a long extent of country; and where, while every thing retards the pursuer below, nothing can stop the object of his pursuit above.

Falconry, that is now so much disused among us, was the principal amusement among our ancestors. A person of rank scarcely stirred out without his hawk on his hand; which, in old paintings, is the criterion of nobility. Harold, afterwards king of England, when he went on a most important embassy into Normandy, is drawn in an old bas-relief, as embarking with a bird on his fist, and a dog under his arm. In those days it was thought sufficient for noblemen's sons to wind the horn, and to carry their hawk fair, and

leave study and learning to the children of meaner people. Indeed, this diversion was in such high esteem among the great all over Europe, that Frederic, one of the emperors of Germany, thought it not beneath him to write a treatise upon hawking.

The expense which attended this sport was very great: among the old Welch princes, the king's falconer was the fourth officer in the state; but notwithstanding all his honours, he was forbid to take more than three draughts of beer from his horn, lest he should get drunk and neglect his duty. In the reign of James I., Sir Thomas Monson is said to have given a thousand pounds for a cast of hawks; and such was their value in general, that it was made felony in the reign of Edward III. to steal a hawk. To take its eggs, even in a person's own ground, was punishable with imprisonment for a year and a day, together with a fine at the king's pleasure. In the reign of Elizabeth the imprisonment was reduced to three months; but the offender was to lie in prison till he got security for his good behaviour for seven years farther. In the earlier times the art of gunning was but little practised, and the hawk was then valuable, not only for its affording diversion, but for its procuring delicacies for the table, that could seldom be obtained any other way.

Of many of the ancient falcons used for this purpose, we at this time know only the names, as the exact species are so ill described, that one may be very easily mistaken for another. Of those in use at present, both here and in other countries, are the gyr-falcon, the falcon, the lanner, the sacre, the hobby, the kestrel, and the merlin.¹ These are called the long-winged hawks, to distinguish them from the gos-hawk, the sparrow-hawk, the kite, and the buzzard, that are of shorter wing, and either too slow, too cowardly, too indolent, or too obstinate, to be serviceable in contributing to the pleasures of the field.

The generous tribe of hawks, as was said, are distinguished from the rest by the peculiar length of their wings, which reach nearly as low as the tail. In these, the first quill of the wing is nearly as long as the second; it terminates in a point, which begins to diminish from about an inch of its extremity. This sufficiently distinguishes the generous breed from that of the baser race or kites, sparrow-hawks, and buzzards, in which the tail is longer than the wings, and the first feather of the wing is rounded at the extremity. They differ also in the latter having the fourth feather of the wing the longest; in the generous race it is always the second.²

This generous race, which have been taken into the service of man, are endowed with natural powers that the other kinds are not possessed of. From the length of their wings, they are swifter

¹ See Supplementary Note A, p. 43.

² See Supplementary Note B, p. 45.

to pursue their game; from a confidence in this swiftness, they are bolder to attack it; and from an innate generosity, they have an attachment to their feeder, and, consequently, a docility which the baser kinds are strangers to.

The gyr-falcon leads in this bold train. He exceeds all other falcons in the largeness of his size, for he approaches nearly to the magnitude of the eagle. The top of the head is flat and of an ash-colour, with a strong, thick, short, and blue beak. The feathers of the back and wings are marked with black spots, in the shape of a heart; he is a courageous and fierce bird, nor fears even the eagle himself; but he chiefly flies at the stork, the heron, and the crane. He is mostly found in the colder regions of the north, but loses neither his strength nor his courage when brought into the milder climates.

The falcon, properly so called, is the second in magnitude and fame. There are some varieties in this bird; but there seem to be only two that claim distinction; the falcon-gentil and the peregrine-falcon; both are much less than the gyr, and somewhat about the size of a raven. They differ but slightly, and perhaps only from the different states they were in when brought into captivity. Those differences are easier known by experience than taught by description. The falcon-gentil³ moults in March, and often sooner; the peregrine-falcon does not moult till the middle of August. The peregrine is stronger in the shoulder, has a larger eye, and yet more sunk in the head; his beak is stronger, his legs longer, and the toes better divided.

Next in size to these is the lanner, a bird now very little known in Europe; then follows the sacre, the legs of which are of a bluish colour, and serve to distinguish that bird; to them succeeds the hobby, used for smaller game, for darning larks, and stooping at quails. The kestrel was trained for the same purposes; and lastly, the merlin, which, though the smallest of all the hawk or falcon kind, and not much larger than a thrush, yet displays a degree of courage that renders him formidable even to birds ten times his size. He has often been known to kill a partridge or a quail at a single pounce from above.

Some of the other species of sluggish birds were now and then trained to this sport, but it was when no better could be obtained; but these just described were only considered as birds of the nobler races. Their courage in general was such, that no bird, not very much above their own size, could terrify them; their swiftness so great, that scarcely any bird could escape them; and their docility so remarkable, that they obeyed not only the commands, but the signs of their master. They remained quietly perched upon his hand till their game was flushed, or else kept hovering round his head, without ever leaving

him but when he gave permission. The common falcon is a bird of such spirit, that, like a conqueror in a country, he keeps all birds in awe and subjection to his prowess. Where he is seen flying wild, as I often had an opportunity of observing, the birds of every kind, that seemed entirely to disregard the kite or the sparrow-hawk, fly with screams at his most distant appearance. Long before I could see the falcon, I have seen them with the utmost signs of terror endeavouring to avoid him; and, like the peasants of a country before a victorious army, every one of them attempting to shift for himself. Even the young falcons, though their spirit be depressed by captivity, will, when brought out into the field, venture to fly at barnacles and wild geese, till, being soundly brushed and beaten by those strong birds, they learn their error, and desist from meddling with such unwieldy game for the future.

To train up the hawk to this kind of obedience, so as to hunt for his master, and bring him the game he shall kill, requires no small degree of skill and assiduity. Numberless treatises have been written upon this subject which are now, with the sport itself, almost utterly forgotten: indeed, except to a few, they seem utterly unintelligible; for the falconers had a language peculiar to themselves, in which they conversed and wrote, and took a kind of professional pride in using no other. A modern reader, I suppose, would be little edified by one of the instructions, for instance, which we find in Willoughby, when he bids us "draw our falcon out of the mew twenty days before we enseat her. If she truss and carry, the remedy is, to cosse her talons, her powse, and petty single."

But, as it certainly makes a part of natural history to show how much the nature of birds can be wrought upon by harsh or kind treatment, I will just take leave to give a short account of the manner of training a hawk, divested of those cant words with which men of art have thought proper to obscure their profession.

In order to train up a falcon, the master begins by clapping straps on his legs, which are called *jeases*, to which there is fastened a ring with the owner's name, by which, in case he should be lost, the finder may know where to bring him back. To these also are added little bells, which serve to mark the place where he is, if lost in the chase. He is always carried on the fist, and is obliged to keep without sleeping. If he be stubborn, and attempts to bite, his head is plunged into water. Thus, by hunger, watching, and fatigue, he is constrained to submit to having his head covered by a hood or cowl, which covers his eyes. This troublesome employment continues often for three days and nights without ceasing. It rarely happens but at the end of this his necessities and the privation of light make him lose all idea of liberty, and bring down his natural wildness. His master judges of his

³ The falcons gentil are now ascertained to be merely the young of the goshawk.—Ed.

being tamed when he permits his head to be covered without resistance, and when uncovered he seizes the meat before him contentedly. The repetition of these lessons by degrees insures success. His wants being the chief principle of his dependence, it is endeavoured to increase his appetite by giving him little balls of flannel, which he greedily swallows. Having thus excited the appetite, care is taken to satisfy it; and thus gratitude attaches the bird to the man who but just before had been his tormenter.

When the first lessons have succeeded, and the bird shows signs of docility, he is carried out upon some green, the head is uncovered, and, by flattering him with food at different times, he is taught to jump on the fist, and to continue there. When confirmed in this habit, it is then thought time to make him acquainted with the lure. This lure is only a thing stuffed like the bird the falcon is designed to pursue, such as a heron, a pigeon, or a quail, and on this lure they always take care to give him his food. It is quite necessary that the bird should not only be made acquainted with this, but fond of it, and delicate in his food when shown it. When the falcon has flown upon this, and tasted the first morsel, some falconers then take it away; but by this there is a danger of daunting the bird; and the surest method is, when he flies to seize it, to let him feed at large, and this serves as a recompense for his docility. The use of this lure is to flatter him back when he has flown in the air, which it sometimes fails to do; and it is always requisite to assist it by the voice and the signs of the master. When these lessons have been long repeated, it is then necessary to study the character of the bird; to speak frequently to him, if he be inattentive to the voice; to stint in his food such as do not come kindly or readily to the lure; to keep waking him, if he be not sufficiently familiar; and to cover him frequently with the hood, if he fears darkness. When the familiarity and the docility of the bird are sufficiently confirmed on the green, he is then carried into the open fields, but still kept fast by a string, which is about twenty yards long. He is then uncovered as before; and the falconer, calling him at some paces distance, shows him the lure. When he flies upon it, he is permitted to take a large morsel of the food which is tied to it. The next day the lure is shown him at a greater distance, till he comes at last to fly to it at the utmost length of his string. He is then to be shown the game itself alive, but disabled or tame, which he is designed to pursue. After having seized this several times with his string, he is then left entirely at liberty, and carried into the field for the purpose of pursuing that which is wild. At that he flies with avidity; and when he has seized it, or killed it, he is brought back by the voice and the lure.

By this method of instruction, a hawk may be taught to fly at any game whatsoever; but fal-

coners have chiefly confined their pursuit only to such animals as yield them profit by the capture, or pleasure in the pursuit. The hare, the partridge, and the quail, repay the trouble of taking them; but the most delightful sport is the falcon's pursuit of the heron, the kite, or the wood-lark. Instead of flying directly forward, as some other birds do, these, when they see themselves threatened by the approach of the hawk, immediately take to the skies. They fly almost perpendicularly upward, while their ardent pursuer keeps pace with their flight, and tries to rise above them. Thus both diminish by degrees from the gazing spectator below, till they are quite lost in the clouds; but they are soon seen descending, struggling together, and using every effort on both sides; the one of rapacious insult, the other of desperate defence. The unequal combat is soon at an end; the falcon comes off victorious, and the other killed or disabled, is made a prey either to the bird or the sportsman.⁴

As for other birds they are not so much pursued, as they generally fly straight forward, by which the sportsman loses sight of the chase, and what is still worse, runs a chance of losing his falcon also. The pursuit of the lark, by a couple of merlins, is considered to him only who regards the sagacity of the chase, as one of the most delightful spectacles this exercise can afford. The amusement is to see one of the merlins climbing to get the ascendant of the lark, while the other, lying low for the best advantage, waits the success of its companion's efforts; thus while the one stoops to strike its prey, the other seizes it at its coming down.

Such are the natural and acquired habits of these birds, which, of all others, have the greatest strength and courage relative to their size. While the kite or the goshawk approach their prey sideways, these dart perpendicularly, in their wild state, upon their game, and devour it on the spot, or carry it off, if not too large for their power of flying. They are sometimes seen descending perpendicularly from the clouds, from an amazing height, and darting down on their prey with inevitable swiftness and destruction.

The more ignoble race of birds make up by cunning and assiduity what these claim by force and celerity. Being less courageous, they are more patient; and having less swiftness, they are better skilled at taking their prey by surprise. The kite, that may be distinguished from all the rest of this tribe by his forked tail and his slow floating motion, seems almost for ever upon the wing. He appears to rest himself upon the bosom of the air, and not to make the smallest effort in flying. He lives only upon accidental carnage, as almost every bird in the air is able to make good its retreat against him. He may be, therefore, considered as an insidious thief, who only prowls about, and when he finds a small

⁴ See Supplementary Note C, p. 46.

bird wounded or a young chicken strayed too far from the mother, instantly seizes the hour of calamity, and, like a famished glutton, is sure to show no mercy. His hunger, indeed, often urges him to acts of seeming desperation. I have seen one of them fly round and round for a while to mark a clutch of chickens, and then on a sudden dart like lightning upon the unresisting little animal, and carry it off, the hen in vain crying out, and the boys hooting and casting stones to scare it from its plunder. For this reason, of all birds the kite is the good housewife's greatest tormentor and aversion.⁵

Of all obscene birds, the kite is the best known; but the buzzard among us is the most plenty. He is a sluggish, inactive bird, and often remains whole days perched together upon the same bough. He is rather an assassin than a pursuer; and lives more upon frogs, mice, and insects, which he can easily seize, than upon birds, which he is obliged to follow. He lives in summer by robbing the nests of other birds, and sucking their eggs, and more resembles the owl kind in his countenance than any other rapacious bird of day. His figure implies the stupidity of his disposition; and so little is he capable of instruction from man, that it is common to a proverb, to call one who cannot be taught, or continues obstinately ignorant, a *buzzard*. The honey-buzzard, the moor-buzzard, and the hen-harrier, are

⁵ The kite is variously diffused throughout England, being a common bird in many parts of the country, and rare in others. In all the wooded districts of the eastern and midland counties it is abundant; it is also met with in Westmoreland; but is seldom seen in the northern parts of Yorkshire, in Durham, or Northumberland. In Scotland, it occurs plentifully in Aberdeenshire, and is found also in the immediate vicinity of Loch Katrine, and of Ben Lomond. The kite is distinguished from other birds of prey by his forked tail. His colour on the head and back is a pale ash. His spread wings measure five feet from tip to tip,—though he weighs rather under three pounds. It is proverbial for the ease and gracefulness of its flight, which generally consists of large and sweeping circles, performed with a motionless wing, or at least with a slight and almost imperceptible stroke of its pinions, and at very distant intervals. In this manner, and directing its course by aid of the tail, which acts as a rudder, and whose slightest motion produces effect, it frequently soars to such a height as to become almost invisible to the human eye. The prey of the kite consists of young game, leverets, rats, mice, lizards, &c., which it takes by pouncing upon the ground. It is a great depredator in farm-yards after chickens, young ducks, and goslings; and is in consequence bitterly retaliated upon as a common enemy in those districts where it abounds. It will also, under the pressure of hunger, devour offal and carrion, and has been known to prey upon dead fish. It breeds early in the spring, in extensive woods, generally making its nest in the fork of a large tree. The nest is composed of sticks, lined with wool, hair, and other soft materials. The eggs are rather larger than those of a hen, and rarely exceed three in number. They are of a grayish-white, speckled with brownish-orange, principally at the larger end; but sometimes they are found quite plain.—Ed.

all of this stupid tribe, and differ chiefly in their size, growing less in the order I have named them.⁶ The goshawk and sparrow-hawk are what Mr. Willoughby calls short-winged birds, and consequently unfit for training, however injurious they may be to the pigeon-house or the sportsman. They have been indeed taught to fly at game; but little is to be obtained from their efforts, being difficult of instruction, and capricious in their obedience. It has been lately asserted, however, by one whose authority is respectable, that the sparrow-hawk is the boldest and the best of all others for the pleasure of the chase.

⁶ See Supplementary Note D, p. 47.

NOTE A.—Of the Falcon species.

The jer, or gyr falcon is of very rare occurrence in England. It is known in the northern parts of Scotland, particularly in the Orkney and Shetland Isles. Iceland is the native country of this species; whence arises its name of *Islandicus*. It was from this island that the royal falconries of Denmark and other northern kingdoms were supplied with their choicest casts of hawks. It breeds in the highest and most inaccessible rocks; but the number and colour of the eggs remain as yet undescribed.—It preys upon the larger species of game and wild-fowl, also on hares and other quadrupeds, upon which it precipitates itself with amazing rapidity and force. Its usual mode of hawking is, if possible to out-soar its prey, and thence to dart perpendicularly upon it. Its breast and belly are white, with darkish spots:—the neck white also, and similarly spotted. The upper part is dark brown inclining to black, with light spots and bars. The tail is barred white and brown; the legs yellow; the claws black:—the head is flat and of an ashen hue; and the bill is a bluish gray.

The uncertainty in which the history of the peregrine falcon was long involved, appears to have arisen from the error of earlier writers, in considering the *Falco peregrinus* and *Falco communis*, with its enumerated varieties, as two distinct species. Deficiency of observation, and consequent want of an accurate knowledge of the various changes of plumage the bird undergoes in its progress to maturity, naturally led to this effect; and we accordingly find, that the bird hitherto described as the *Falco communis*, the type of the supposed species, and its varieties, must have been originally figured from an immature specimen of the *Falco peregrinus*. In England and Wales the Peregrine falcon is rare, and is only found indigenous in rocky or mountainous districts. The Highlands and Northern Isles of Scotland appear to be the situations most favourable to it, and in that part of the kingdom it is numerous and widely diffused.—The most inaccessible situations are always selected for its eyry, and its nest is placed upon the shelf of a rock. It lays four or five eggs, in colour very similar to those of the kestrel, but considerably larger. The flight of this species, when pursuing its quarry, is astonishingly rapid, almost beyond credibility. By Montague it has been reckoned at 150 miles in an hour. Colonel Thornton, an expert falconer, estimated the flight of a falcon, in pursuit of a snipe, to have been nine miles in eleven minutes, without including the frequent turns. This sort was formerly much used in falconry, and was flown at the larger kinds of game, wild ducks and herons. In its unreclaimed state it preys upon the different sorts of game, wild geese,

wild ducks and pigeons. "In daring disposition," says Mr. Selby, speaking of this bird, "it equals most of its congeners. I may be allowed to add the following instance, as having happened under my own observation, and as exemplifying not only its determined perseverance in pursuit of its prey, when under the pressure of hunger, but as arguing also an unexpected degree of foresight:—In exercising my dogs upon the moors, previous to the commencement of the shooting-season, I observed a large bird of the hawk genus, hovering at a distance, which, upon approaching, I knew to be a peregrine falcon. Its attention was now drawn towards the dogs, and it accompanied them, whilst they beat the surrounding ground. Upon their having found, and sprung a brood of grouse, the falcon immediately gave chase, and struck a young bird, before they had proceeded far upon wing. My shouts and rapid advance prevented it from securing its prey. The issue of this attempt, however, did not deter the falcon from watching our subsequent movements, and another opportunity soon offering, it again gave chase, and struck down two birds, by two rapidly repeated blows, one of which it secured, and bore off in triumph."

In England, the hobby is among the number of those birds that are named polar-migrants or summer periodical visitants. It arrives in April, and after performing the offices of incubation, and of rearing its young, leaves us, for warmer latitudes, in October. Wooded and enclosed districts appear to be its usual haunts. It builds in lofty trees, but will sometimes save itself the task of constructing a nest, by taking possession of the deserted one of a magpie or crow. The number of its eggs is commonly four, of a bluish-white, with olive-green or yellowish-brown blotches. Its favourite game is the lark, but it preys upon all small birds. Partridges and quails also become frequent victims to its courage and rapacity, in which qualities, diminutive as it is, it yields to none of its tribe. Possessing a great length and power of wing, the flight of the hobby is wonderfully rapid, and can be supported with undiminished vigour for a considerable time. When hawking was keenly followed, the hobby was trained to the pursuit of young partridges, snipes, and larks. It is of elegant form, and resembles, in miniature, the peregrine falcon. The wings, when closed, generally reach beyond the end of the tail. According to Temminck, it is common throughout Europe during the summer months; but retires to warmer regions at the approach of winter.

The kestrel is distinguished, not only by the symmetry of its form and its elegant plumage, but by the peculiar gracefulness of its flight, and the manner in which it frequently remains suspended in the air, fixed, as it were, to one spot, by a quivering play of the wings, scarcely perceptible. It is one of our commonest indigenous species, and is widely spread through the kingdom. Upon the approach of spring (or the period of incubation), it resorts to rocks and high cliffs. The nest consists of a few sticks loosely put together, and sometimes lined with a little hay or wool; and is placed in some crevice, or on a projecting shelf. The eggs are from four to six in number, of a reddish-brown colour, with darker blotches and variegations.—It preys upon the different species of mice, which it hunts for from the elevated station at which it usually soars, and upon which it pounces with the rapidity of an arrow. The kestrel is easily reclaimed, and was formerly trained to the pursuit of larks, snipes, and young partridges. It is a species, in point of geographical distribution, very widely spread, being found in all parts of Europe and in America. Of this widely diffused and well known species, Mr. Selby says: "The castings of a nest of young kestrels that I frequently inspected, consisted entirely of the fur and

bones of mice: and Montague remarks, that he never found the feathers or remains of birds in the stomach of this hawk. He therefore concluded, that it is only when it finds a difficulty in procuring its favourite food, that it attacks and preys on the feathered tribe. That it will do so, under some circumstances, is evident, since bird-catchers have discovered the kestrel in the very act of pouncing their bird-calls: and I have myself caught it in a trap baited with a bird. In summer, the cockchafer supplies to this species an object of pursuit and food, and the following curious account is given from an eye-witness of the fact. 'I had,' says he, 'the pleasure, this summer, of seeing the kestrel engaged in an occupation entirely new to me, hawking after cockchafers late in the evening. I watched him through a glass, and saw him dart through a swarm of the insects, seize one in each claw, and eat them whilst flying. He returned to the charge again and again.'" A sparrow, pressed by a kestrel hawk, flew into the window of a dwelling-house, at Beargate, in Exeter; and so eager was the pursuer to obtain possession of the quarry, in the wing of which he had already fastened his talons, that the window was closed upon them, and both were captured.

The merlin has generally been considered a winter or equatorial visitant, and to leave Great Britain at the approach of spring, for other and more northern climates. Its migration is however confined to the southern parts of the island. Inferior as this species is in size, it fully supports the character of its tribe; frequently attacking birds superior to itself in magnitude and weight, and has been known to kill a partridge at a single blow.—Like others before enumerated, it became subjected to the purposes of pastime, and was trained to pursue partridges, snipes, and woodcocks. Its flight is low and rapid, and it is generally seen skimming along the sides of hedges in search of its prey.

The secretary falcon, an inhabitant of the south of Africa, is a singular bird, for whose natural history we are chiefly indebted to the indefatigable labours of M. le Vaillant. Its body, when standing erect, is not much unlike the crane; but its head, bill, and claws are precisely those of the falcon. The general colour of the plumage is a bluish-ash: the tips of the wings, the thighs, and the vent, being blackish: the tail is black near the end, but the very tip is white: the legs are long, so that it measures, standing erect, full three feet from the top of the head to the ground. On the back of the head are several long dark-coloured feathers, hanging down behind, and which it can erect at pleasure. This crest has induced the Dutch at the Cape to give it the name of the secretary, from the resemblance they fancy it has to the pen of a writer, when in the time of leisure it is stuck behind the ear. The food to which this bird is particularly attached consists of snakes and other reptiles, for the destruction of which it is admirably fitted by its organization. In the craw of one M. le Vaillant found eleven tolerably large lizards, three serpents as long as his arm, eleven small tortoises of about two inches in diameter, and a number of locusts and other insects, some of which were so entire that he added them to his collection. The mode in which it seizes serpents is very peculiar. When it approaches them it is always careful to carry the one point of its wings forward, in order to parry off their venomous bites; sometimes it finds an opportunity of spurning and treading upon its antagonist, or else of taking him on his pinions and throwing him into the air. When by this proceeding it has at length wearied out its adversary, and rendered him almost senseless, it kills and swallows him at leisure without danger.

NOTE B.—Of the Hawk species.

The goshawk is very rarely met with in England. In the wild and mountainous districts of Scotland it is more common, and is known to breed in the forest of Rothiemurchus, and on the wooded banks of the Dee; and, according to Low, in his 'Fauna Orcadensis,' is rather numerous in those islands (the Orkneys), where it breeds in the rocks and sea-cliffs. Its flight is very rapid, but generally low, and it strikes its prey upon the wing. Different kinds of feathered game, wild ducks, hares, and rabbits form its principal food. According to Mayer, it will even prey upon the young of its own species. It generally builds in lofty fir trees, and lays from two to four eggs, of a skin-milk white, marked with streaks and spots of reddish-brown. By falconers, it was considered to be the best and most courageous of the short-winged hawks, and was accordingly trained to the pursuit of grouse, pheasants, wild geese, herons, &c. Although it is nearly equal in size to the jer-falcon, yet the shortness of its wings, and its general contour, readily distinguish it from that species, in all its stages of plumage. The goshawk is very common in France, as well as in Germany, Switzerland, and Russia. In Holland it is rare. The '*Falcon gentil*,' from its description, must be referred to this species. In the year 1830, a goshawk was observed to alight upon a high rock in the island of Kerrara, Argyshire, where it was soon disturbed by two of a species of hooded crow, very common in that quarter. The goshawk, apparently not anxious for a quarrel, made majestically out to sea, pursued by the crows, which no doubt thought that its retreat proved their superiority to it. This made them risk too much—the hawk, enraged at last by their insolence, suddenly wheeled round and made a stroke at one of them, which caused it to fall downwards almost into the waves ere it could recover itself sufficiently to fly to shore. The remaining crow was ultimately reinforced by some sea-gulls, and a screaming contest was maintained as long as the party remained in sight, flying off towards Mull.

The sparrow-hawk, a destructive and well-known species, is remarkable for the great difference in size between the male and female; the former seldom measuring twelve inches in length, whilst the latter often exceeds fifteen inches. It is one of the boldest of its genus, and the female, from her superior size, is a fatal enemy to partridges and other game, as well as pigeons. It flies low, skimming over the ground with great swiftness, and pounces its prey upon the wing with unerring aim. The force of its stroke is such as generally to kill, and sometimes even to force out the entrails of its victim. It is common in most parts of the kingdom, but particularly frequents the lower grounds, and well-wooded enclosures. It builds in low trees, or thorn-bushes, forming a shallow and flat nest, composed of slender twigs, and very similar to that of the ring-dove but rather larger. It will occasionally occupy the deserted nest of a crow. The sparrow-hawk is very widely diffused, and found in all parts of Europe. In the days of falconry it was trained, and much approved in the pursuit of partridges, quails, and many other birds.

Mr. W. B. Clarke, in the 'Magazine of Natural History,' gives the following interesting account of a tame sparrow-hawk. "About three years ago (1828), a young sparrow-hawk was purchased, and brought up by my brother. This was rather hazardous, as he, at the same time, had a large stock of fancy pigeons, which, in consequence of their rarity and value, he greatly prized. It seems, however, that kindness and ease had softened the nature of the hawk, or the regularity with which he was fed ren-

dered the usual habits of his family unnecessary to his happiness; for as he increased in age and size, his familiarity increased also, leading him to form an intimate acquaintance with a set of friends who have been seldom seen in such society. Whenever the pigeons came to feed, which they did oftentimes from the hand of their almoner, the hawk used also to accompany them. At first the pigeons were shy, of course; but, by degrees, they got over their fears, and ate as confidently as if the ancient enemies of their race had sent no representative to their banquet. It was curious to observe the playfulness of the hawk, and his perfect good nature during the entertainment; for he received his morsel of meat without any of that ferocity with which birds of prey usually take their food, and merely uttered a cry of lamentation when the carver disappeared. He would then attend the pigeons in their flight round and round the house and gardens, and perch with them on the chimney-top, or roof of the mansion; and this voyage he never failed to make early in the morning, when the pigeons always took their exercise. At night, he retired with them to the dove-cot: and though for some days he was the sole occupant of the place, the pigeons not having relished this intrusion at first, he was afterwards merely a guest there; for he never disturbed his hospitable friends, even when their young ones, unfledged and helpless as they were, offered a strong temptation to his appetite. He seemed unhappy at any separation from the pigeons, and invariably returned to the dove-house after a few purposed confinements in another abode, during which imprisonment he would utter most melancholy cries for deliverance: but these were changed to cries of joy on the arrival of any person with whom he was familiar. All the household were on terms of acquaintance with him; and there never was a bird who seemed to have one such general admiration. He was as playful as a kitten, and, literally, as loving as a dove.

"But that his nature was not altogether altered, and that, notwithstanding his education, which, as Ovid says,

Emollit mores, nec sinit esse feros,

he was still a hawk of spirit, was proved on an occasion of almost equal interest. A neighbour had sent us a very fine specimen of the smaller horned owl, (*Strix brachyotus*), which he had winged when flying in the midst of a covey of partridges; and after having tended the wounded bird, and endeavoured to make a cure, we thought of soothing the prisoner's captivity by a larger degree of freedom than he had in the hen-coop, which he inhabited. No sooner, however, had our former acquaintance, the hawk, got sight of him, than he fell upon the poor owl most unmercifully; and from that instant, whenever they came in contact, a series of combats commenced, which equalled in skill and courage any of those which have so much distinguished that hero, who to the boldness and clearness of vision of the hawk, unites the wisdom of the bird of Athens. The defence of the poor little owl was admirably conducted; he would throw himself upon his back, and await the attack of his enemy with patience and preparation; and, by dint of biting and scratching, would frequently win a positive, as he often did a negative, victory. Acquaintanceship did not seem in this case likely to ripen into friendship; and when his wing had gained strength, taking advantage of a favourable opportunity, the owl decamped, leaving the hawk in possession of his territory. The fate of the successful combatant was, however, soon to be accomplished; for he was shortly after found drowned in a butt of water, from which he had once or twice been extricated before, having summoned a deliverer to his assistance by cries that told he was in distress."

NOTE C.—*Hawking in Persia.*

"The huntsmen proceed to a large plain, or rather desert, near the sea-side; they have hawks and greyhounds; the former carried in the usual manner, on the hand of the huntsman; the latter led in a leash by a horseman, generally the same who carries the hawk. When the antelope is seen they endeavour to get as near as possible: but the animal the moment it observes them goes off at a rate that seems swifter than the wind; the horsemen are instantly at full speed; having slipped the dogs. If it is a single deer, they at the same time fly the hawks; but if a herd, they wait till the dogs have fixed on a particular antelope. The hawks skimming along near the ground, soon reach the deer, at whose head they pounce in succession, and sometimes with a violence that knocks it over—at all events, they confuse the animal so much as to stop its speed in such a degree that the dogs can come up with it; and, in an instant, men, horses, dogs, and hawks surround the unfortunate deer against which their united efforts have been combined. The part of the chase which surprised me most, was the extraordinary combination of the hawks and the dogs, which throughout seemed to look to each other for aid. This, I was told, is the result of long and skilful training. The antelope is supposed to be the fleetest quadruped on earth; and the rapidity of the first burst of the chase I have described is astonishing. The run seldom exceeds three or four miles, and often is not half so much. A fawn is an easy victory; the doe often runs a good chase; and the buck is seldom taken. The Arabs are indeed afraid to fly their hawks at the latter, as these fine birds, in pouncing, frequently impale themselves on its sharp horns. The hawks used in this kind of sport are of a species that I have never seen in any country. This breed, which is called the *cherkh*, is not large, but of great beauty and symmetry. Another mode of running down the antelope is practised here, and still more in the interior of Persia. Persons of the highest rank lead their own greyhounds in a long silken leash, which passes through the collar, and is ready to slip the moment the huntsman chooses. The well-trained dog goes alongside the horse, and keeps clear of him when in full speed, and in all kinds of country. When a herd of antelopes is seen, a consultation is held, and the most experienced determine the point towards which they are to be driven. The field (as an English sportsman would term it) then disperse, and while some drive the herd in the desired direction, those with the dogs take their post on the same line, at the distance of about a mile from each other; one of the worst dogs is then slipped at the herd, and from the moment he singles out an antelope the whole body are in motion. The object of the horsemen who have greyhounds is to intercept its course, and to slip fresh dogs, in succession at the fatigued animal. In rare instances the second dog kills. It is generally the third or fourth; and even these, when the deer is strong, and the ground favourable, often fail. This sport, which is very exhilarating, was the delight of the late king of Persia, Aga Mohammed Khan, whose taste is inherited by the present sovereign. The novelty of these amusements interested me, and I was pleased, on accompanying a party to a village, about twenty miles from Aboo-Shahr, to see a species of kawking, peculiar, I believe, to the sandy plains of Persia, on which the *hobara*—a noble species of bustard—is found on almost bare plains, where it has no shelter but a small shrub, called *geetuck*. When we went in quest of them, we had a party of about twenty, all well-mounted. Two kinds of hawks are necessary for this sport; the first, the *cherkh*—the same

which is flown at the antelope—attacks them on the ground, but will not follow them on the wing; for this reason, the *bhyree*, a hawk well known in India, is flown the moment the *hobara* rises. As we rode along in an extended line, the men who carried the *cherkhs* every now and then unhooded and held them up, that they might look over the plain. The first *hobara* we found gave us a proof of the astonishing quickness of sight of one of the hawks; he fluttered to be loose; and the man who held him gave a whoop as he threw him off his hand, and set off at full speed. We all did the same. At first we only saw our hawk skimming over the plain, but soon perceived, at a distance of more than a mile, the beautiful speckled *hobara*, with his head erect and wings outspread, running forward to meet his adversary. The *cherkh* made several unsuccessful pounces, which were either evaded or repelled by the beak or the wings of the *hobara*, which at last found an opportunity of rising, when a *bhyree* was instantly flown, and the whole party were again at full gallop. We had a flight of more than a mile, when the *hobara* alighted, and was killed by another *cherkh*, who attacked him on the ground. This bird weighed 10 lbs. We killed several others, but were not always successful, having seen our hawks twice completely beaten during the two days we followed this fine sport."—*Malcolm's Sketches of Persia.*

NOTE D.—*Of Buzzards and Harriers.*

The common buzzard preys upon leverets, rabbits, game, and small birds, all of which it pounces on the ground. It also devours moles and mice, and when pressed by hunger will feed on reptiles and insects. It breeds in woods, and forms its nest of sticks, lined with wool, hay, and other materials, and will sometimes occupy the deserted nest of a crow. The eggs are two or three in number, larger than those of a hen, and are white, either plain or spotted with reddish-brown. The young, according to Pennant, remain in company with the parent birds for some time after having quitted the nest,—a circumstance at variance with the usual habits of birds of prey. It is common in all the wooded parts of Europe, and according to Temminck, very abundant in Holland. In France this bird is killed during the winter for the sake of its flesh, which is esteemed delicious eating.

The rough-legged buzzard is a rare British species, and can only be considered as an occasional visitant. Montague mentions two or three instances of its having been taken in the South of England. It is a native of Norway, and other northern countries of Europe, where it frequents marshy districts, preying upon leverets, hamsters, water-rats, moles, and frequently lizards and frogs. According to Temminck, it builds in lofty trees, and lays four white eggs, spotted with reddish-brown. "Two of these birds," says Selby, "from having attached themselves to a neighbouring marsh, passed under my frequent observation. Their flight was smooth, but slow, and not unlike that of the common buzzard, and they seldom continued for any length of time on the wing. They preyed upon wild ducks and other birds, which they mostly pounced upon on the ground; and it would appear, that mice and frogs must have constituted a great part of their food, as the remains of both were found in the stomachs of those that were killed."

The honey buzzard preys upon moles, mice, and small birds, and on lizards and insects, particularly wasps, bees, and their larvæ, which should appear to be their favourite food. Its flight is easy and graceful, and it is frequently seen near pieces of water, on account of the libellulæ, and other aquatic insects. It breeds in lofty trees, forming a nest of

twigs lined with wool, and other soft materials. The eggs are small, in proportion to the size of the bird, of a yellowish-white, marked with numerous spots and stains of reddish-brown, sometimes so confluent as to make them appear almost entirely brown. It is a native of eastern climes, and according to Temminck, is as rare in Holland as in England. In the south of France it is more abundant, but migratory.

Allied to the buzzards are the harriers. They are bolder and more active than the buzzards. They strike their prey upon the ground, and generally fly very low.

The marsh-harriers abound in all the marshy districts of England and Scotland, and, according to Montague, are very numerous in Wales, where they prey upon the rabbits that inhabit the sand-banks of the shores of Caermarthenshire. In Holland they are of course numerous, from the nature of the country, and rare in Switzerland.

The hen-harrier, though not very numerous, is pretty generally found throughout Britain, frequenting low marshy situations, or wide moors. The flight of the hen-harrier is always low, but at the same time smooth and buoyant. It is very destructive to game, which it pounces upon the ground; it also feeds upon small birds and animals, lizards and frogs. It breeds on the open wastes, and frequently in thick furze covers; the nest is placed on the ground, and the eggs are four or five in number, of a skim-milk white, round at each end, and nearly as large as the marsh-harrier. The young males for the first year, are similar in appearance to the females, after which they gradually assume the gray plumage that distinguishes the adult. It is common in France, Germany, and Holland, inhabiting the low and flat districts; but in Switzerland, and all mountainous countries, it is of rare occurrence.

The ash-coloured harrier also belongs to the British fauna. The resemblance it bears to the hen-harrier was without doubt the cause of its remaining so long unnoticed as a separate species, having in all probability, when previously met with, been considered only as a variety of that bird. The ash-coloured harrier is far from being numerous in England. It skims along the surface of the ground, like the hen-harrier, but with more rapid flight, and more strikingly buoyant; lives upon small birds, lizards, frogs, &c. Its nest is placed upon the ground, amongst furze or low brushwood. The eggs are generally four, and of a pure white. According to Temminck, it is found throughout Hungary, in Poland, Silesia, and Austria. It is common also in Dalmatia and the Illyrian provinces, but is of rare occurrence in Italy.

CHAP. VI.

THE BUTCHER-BIRD.

BEFORE I conclude this short history of rapacious birds that prey by day, I must take leave to describe a tribe of smaller birds, that seem from their size rather to be classed with the harmless order of the sparrow kind; but that from their crooked beak, courage, and appetites for slaughter, certainly deserve a place here. The lesser butcher-bird is not much above the size of a lark; that of the smallest species is not so big as a sparrow; yet, diminutive as these little animals are, they make themselves formidable to birds of four times their dimensions.

The greater butcher-bird is about as large as a thrush; its bill is black, an inch long, and hooked at the end. This mark, together with its carnivorous appetites, ranks it among the rapacious birds; at the same time that its legs and feet, which are slender, and its toes, formed somewhat differently from the former, would seem to make it the shade between such birds as live wholly upon flesh, and such as live chiefly upon insects and grain.

Indeed, its habits seem entirely to correspond with its conformation, as it is found to live as well upon flesh as upon insects, and thus to partake, in some measure, of a double nature. However, its appetite for flesh is the most prevalent; and it never takes up with the former when it can obtain the latter. This bird, therefore, leads a life of continual combat and opposition. As from its size it does not much terrify the smaller birds of the forest, so it very frequently meets birds willing to try its strength, and it never declines the engagement.

It is wonderful to see with what intrepidity this little creature goes to war with a pie, the crow, and the kestrel, all above four times bigger than itself, and that sometimes prey upon flesh in the same manner. It not only fights upon the defensive, but often comes to the attack, and always with advantage, particularly when the male and female unite to protect their young, and to drive away the more powerful birds of rapine. At that season they do not wait the approach of their invader; it is sufficient that they see him preparing for the assault at a distance. It is then that they sally forth with loud cries, wound him on every side, and drive him off with such fury, that he seldom ventures to return to the charge. In these kinds of disputes they generally come off with the victory; though it sometimes happens that they fall to the ground with the bird they have so fiercely fixed upon, and the combat ends with the destruction of the assailant as well as the defender.

For this reason, the most redoubtable birds of prey respect them; while the kite, the buzzard, and the crow, seem rather to fear than seek the engagement. Nothing in nature better displays the respect paid to the claims of courage than to see this little bird, apparently so contemptible, fly in company with the lanner, the falcon, and all the tyrants of the air, without fearing their power, or avoiding their resentment.

As for small birds, they are its usual food. It seizes them by the throat, and strangles them in an instant. When it has thus killed the bird or insect, it is asserted by the best authority that it fixes them upon some neighbouring thorn, and, when thus spitted, pulls them to pieces with its bill. It is supposed, that as Nature has not given this bird strength sufficient to tear its prey to pieces with its feet, as the hawks do, it is obliged to have recourse to this extraordinary expedient.

During summer, such of them as constantly

reside here, for the smaller red-butcher migrates, remain among the mountainous parts of the country: but in winter they descend into the plains, and nearer human habitations. The larger kind make their nests on the highest trees, while the lesser build in bushes in the fields and hedge-rows. They both lay about six eggs, of a white colour, but encircled at the bigger end with a ring of brownish red. The nest on the outside is composed of white moss, interwoven with long grass; within it is well lined with wool, and is usually fixed among the forking branches of a tree. The female feeds her young with caterpillars and other insects while very young; but soon after accustoms them to flesh, which the male procures with surprising industry. Their nature also is very different from other birds of prey in their parental care; for, so far from driving out their young from the nest to shift for themselves, they keep them with care; and even when adult they do not forsake them, but the whole brood live in one family together. Each family lives apart, and is generally composed of the male, female, and five or six young ones; these all maintain peace and subordination among each other, and hunt in concert. Upon the returning season of courtship, this union is at an end, the family parts for ever, each to establish a little household of its own. It is easy to distinguish these birds at a distance, not only from their going in companies, but also from their manner of flying, which is always up and down, seldom direct or sideways.

Of these birds there are three or four different kinds; but the greater ash-coloured butcher-bird is the least known among us. The red-backed butcher-bird migrates in autumn, and does not return till spring. The wood-chat resembles the former, except in the colour of the back, which is brown, and not red as in the other. There is still another, less than either of the former, found in the marshes near London. This too is a bird of prey, although not much bigger than a titmouse; an evident proof that an animal's courage or rapacity does not depend upon its size. Of foreign birds of this kind there are several; but as we know little of their manner of living we will not, instead of history, substitute mere description. In fact, the colours of a bird, which is all we know of them, would afford a reader but small entertainment in the enumeration. Nothing can be more easy than to fill volumes with the different shades of a bird's plumage; but these accounts are written with more pleasure than they are read; and a single glance of a good plate or picture imprints a juster idea than a volume could convey.

SUPPLEMENTARY NOTE.

The tribe of birds here noticed under the name of butcher-birds are otherwise called *shrikes*. Shrikes are spread over the entire globe, and everywhere exhibit similar dispositions, habits, and modes of ex-

istence. Of small size, but armed with a strong and crooked beak, of a fierce and courageous disposition, and of a sanguinary appetite, they bear much affinity to the birds of prey. Naturally intrepid, they defend themselves vigorously, and do not hesitate to attack birds much stronger and larger than themselves. The European shrikes can combat with advantage, pies, crows, and even kestrels. They attack and pursue these birds with great ferocity, if they dare to approach their nests. It is even sufficient if any of them should pass within reach. The male and female shrikes unite, fly forth, attack them with loud cries, and pursue them with such fury, that they often take to flight without daring to return. Even kites, buzzards, and ravens will not willingly attack the shrike. They are habitually insectivorous, and also pursue small birds. They will cast themselves on thrushes, blackbirds, &c., when these last are taken in a snare. When they have seized a bird they open the cranium, devour the brain, deplume the body, and tear it piece-meal. The prudence to foresee and provide for the wants of the future, is another of their qualities. That they may not fail of those insects which form their subsistence, and which only make their appearance at a determinate epoch, some shrikes form kinds of magazines, not in the hollows of trees, nor in the earth, but in the open air. They stick their superabundant prey on thorns, where they may find it again in the hour of need.

Falconers have taken advantage of the character of these birds, and occasionally trained them to the chase. Francis I. of France, according to the account of Turner, was accustomed to hunt with a tame shrike, which used to speak, and return upon the hand. The Swedish hunters, availing themselves of the habit of the gray shrike of uttering a peculiar sort of cry at the approach of a hawk, make use of it to discover the birds of prey which this kind of cry announces.

Though we have said that the shrike genus is extended over the entire globe, we believe South America must be excepted. The South American birds which have been called shrikes belong to other divisions, and it would appear that this genus does not pass beyond the Floridas, Louisiana, and the north of Mexico.

The red-backed shrike or lesser butcher-bird is about 7 inches long. Its bill is black; the head and lower part of the back, and coverts of the wings, are of a bright rusty red; the breast, belly, and sides, are of a fine pale rose or bloom colour, the throat is white; a stroke of black passes from the bill through each eye; the two middle feathers of the tail are black, the others are white at the base: the quills are of a brown colour; and the legs are black. The female, like all other birds of prey, is larger than the male; it builds its nest in hedges or low bushes, and lays six white eggs, marked with a reddish-brown circle towards the larger end. This bird preys on young birds, which it takes in the nest; it likewise feeds on grasshoppers and beetles. It is migratory in Great Britain, and various other temperate countries of Europe.

Bell, in his 'Travels from Moscow, through Siberia,' to Pekin, says, that in Russia these birds are often taken by the bird-catchers, and made tame. He had one of them given to him, which he taught to perch on a sharpened stick fixed in the wall of his apartment. Whenever a small bird was let loose in the room, the butcher-bird would immediately fly from his perch, and seize it by the throat in such a manner as to suffocate it almost in a moment. He would then carry it to his perch, and spit it on the end, which was sharpened for the purpose, drawing it on carefully and forcibly with his bill and claws. If several birds were given him, he would use them

all, one after another, in the same manner. These were so fixed, that they hung by the neck till he had leisure to devour them. This singular practice has given rise to the appellation of butcher-bird.

We add the following from Mr. Rennie, on the architecture of birds:—"We discovered near those nests large insects, such as humble bees, and that the unfledged nestlings of small birds were frequently seen stuck upon thorns; but we obtained what we considered good proof of the fact: for the peasants all concurred in affirming, that the butcher-bird fixes its prey upon thorns,—not, however, according to their belief, to allure large game, but to kill or secure what has been already captured. Selby, an eminent living naturalist, has confirmed the fact. 'I had the gratification,' he says, 'of witnessing this operation of the shrike, upon a hedge accentor which it had just killed, and the skin of which still attached to the thorn, is now in my possession. In this instance, after killing the bird, it hovered with it in its bill for a short time over the hedge, apparently occupied in selecting a thorn for its purpose. Upon disturbing it, and advancing to the spot, I found the accentor firmly fixed by the tendons of the wing, at the selected twig.' 'I have met,' continues Selby, 'with the remains of a mouse in the stomach of a shrike, and Montague mentions one in which he found a shrew. When confined in a cage, this bird still evinces the same propensity for fixing its food, and, if a sharp-pointed stick or thorn is not left for that purpose, it will invariably fasten it to the wires before commencing its repast.' It is very bold, and will attack almost any bird that intrudes upon its localities.

In America, the great shrike has been observed to adopt an odd stratagem for the purpose of decoying its prey. A gentleman there, accidentally observing that several grasshoppers were stuck upon the sharp thorny branches of some trees, inquired of a person who lived close by, the cause of the phenomenon, and was informed that they were stuck there by this bird, which is called by the English settlers, the *nine-killer*. On farther inquiry, he was led to suppose that this was an instinctive stratagem adopted by the bird, in order to decoy the smaller birds, which feed on insects, into a situation whence he could dart on them. He is called the *nine-killer*, from the supposition that he sticks up nine grasshoppers in succession. That the insects are placed there as food to tempt other birds, is said to appear from their being frequently left untouched for a considerable length of time.

Le Vaillant gives the following account of the shrike of Southern Africa (*Lanius collurio*). "When it sees a locust or mantis, or a small bird, it springs upon it, and immediately carries it off, in order to impale it on a thorn, which it does with great dexterity, always passing the thorn through the head of its victim. Every animal which it seizes is subjected to the same fate: and it thus continues all day long its murderous career, apparently instigated rather by the love of mischief than the desire of food. Its throne of tyranny is usually a dry and elevated branch of a tree, from which it pounces on all intruders, driving off the stronger and more troublesome, and impaling the inexperienced alive; when hungry it besets its shambles, and helps itself to a savoury meal."

CHAP. VII.

OF RAPACIOUS BIRDS OF THE OWL KIND, THAT PREY BY NIGHT.

HITHERTO we have been describing a tribe of animals who, though plunderers among their fellows of the air, yet wage war boldly in the face of day. We now come to a race equally cruel and rapacious; but who add to their savage disposition the further reproach of treachery, and carry on all their depredations by night.

All birds of the owl kind may be considered as nocturnal robbers, who, unfitted for taking their prey while it is light, surprise it at those hours of rest when the tribes of nature are in the least expectation of an enemy. Thus there seems no link in Nature's chain broken: nowhere a dead inactive repose: but every place, every season, every hour of the day and night, is bustling with life, and furnishing instances of industry, self-defence, and invasion.

All birds of the owl kind have one common mark by which they are distinguished from others; their eyes are formed for seeing better in the dusk than in the broad glare of sunshine. As in the eyes of tigers and cats, that are formed for a life of nocturnal depredation, there is a quality in the retina that takes in the rays of light so copiously as to permit their seeing in places almost quite dark; so in these birds there is the same conformation of that organ, and though, like us, they cannot see in a total exclusion of light, yet they are sufficiently quick-sighted at times when we remain in total obscurity. In the eyes of all animals Nature hath made a complete provision, either to shut out too much light, or to admit a sufficiency, by the contraction and dilatation of the pupil. In these birds the pupil is capable of opening very wide, or shutting very close: by contracting the pupil, the brighter light of the day, which would act too powerfully upon the sensibility of the retina, is excluded; by dilating the pupil, the animal takes in the more faint rays of the night, and thereby is enabled to spy its prey, and catch it with greater facility in the dark. Besides this, there is an irradiation on the back of the eye, and the very iris itself has a faculty of reflecting the rays of light, so as to assist vision in the gloomy places where these birds are found to frequent.

But though owls are dazzled by too bright a daylight, yet they do not see best in the darkest nights, as some have been apt to imagine. It is in the dusk of the evening, or the gray of the morning, that they are best fitted for seeing, at those seasons when there is neither too much light nor too little. It is then that they issue from their retreats, to hunt or to surprise their prey, which is usually attended with great success: it is then that they find all other birds

asleep, or preparing for repose, and they have only to seize the most unguarded.

The nights when the moon shines are the times of their most successful plunder; for when it is wholly dark, they are less qualified for seeing and pursuing their prey: except, therefore, by moonlight, they contract the hours of their chase; and if they come out at the approach of dusk in the evening, they return before it is totally dark, and then rise by twilight the next morning to pursue their game, and to return in like manner before the broad daylight begins to dazzle them with its splendour.

Yet the faculty of seeing in the night, or of being entirely dazzled by the day, is not alike in every species of these nocturnal birds: some see by night better than others; and some are so little dazzled by daylight that they perceive their enemies, and avoid them. The common white or barn owl, for instance, sees with such exquisite acuteness in the dark, that though the barn has been shut at night, and the light thus totally excluded, yet it perceives the smallest mouse that peeps from its hole: on the contrary, the brown horned owl is often seen to prowl along the hedges by day, like the sparrow-hawk; and sometimes with good success.

All birds of the owl kind may be divided into two sorts: those that have horns, and those without. These horns are nothing more than two or three feathers that stand upon each side of the head over the ear, and give this animal a kind of horned appearance. Of the horned kind is the great horned owl, which at first view appears as large as an eagle. When he comes to be observed more closely, however, he will be found much less. His legs, body, wings, and tail, are shorter; his head much larger and thicker: his horns are composed of feathers that rise above two inches and a half high, and which he can erect or depress at pleasure: his eyes are large and transparent, encircled with an orange-coloured iris: his ears are large and deep, and it would appear that no animal was possessed with a more exquisite sense of hearing: his plumage is of a reddish brown, marked on the back with black and yellow spots, and yellow only upon the belly.

Next to this is the common horned owl, of a much smaller size than the former, and with horns much shorter. As the great owl was five feet from the tip of one wing to the other, this is but three. The horns are but about an inch long, and consist of six feathers, variegated with black and yellow.

There is still a smaller kind of the horned owl, which is not much larger than a blackbird; and whose horns are remarkably short, being composed but of one feather, and that not above half-an-inch high.

To these succeeds the tribe without horns. The howlet, which is the largest of this kind, with dusky plumes and black eyes; the screech

owl, of a smaller size, with blue eyes, and plumage of an iron gray; the white owl, about as large as the former, with yellow eyes and whitish plumage; the great brown owl, less than the former, with brown plumage and a brown beak; and lastly, the little brown owl, with yellowish coloured eyes, and an orange-coloured bill. To this catalogue might be added others of foreign denominations, which differ but little from our own, if we except the harfang, or great Hudson's Bay owl of Edwards, which is the largest of all the nocturnal tribe, and as white as the snows of the country of which he is a native.

All this tribe of animals, however they may differ in their size and plumage, agree in their general characteristics of preying by night, and having their eyes formed for nocturnal vision. Their bodies are strong and muscular; their feet and claws made for tearing their prey; and their stomachs for digesting it. It must be remarked, however, that the digestion of all birds that live upon mice, lizards, or such like food, is not very perfect; for though they swallow them whole, yet they are always seen some time after to disgorge the skin and bones, rolled up in a pellet, as being indigestible.

In proportion as each of these animals bears the daylight best, he sets forward earlier in the evening in pursuit of his prey. The great horned owl is the foremost in leaving his retreat; and ventures into the woods and thickets very soon in the evening. The horned, and the brown owl, are later in their excursions; but the barn-owl seems to see best in profound darkness, and seldom leaves his hiding-place till midnight.

As they are incapable of supporting the light of the day, or at least of then seeing and readily avoiding their danger, they keep all this time concealed in some obscure retreat, suited to their gloomy appetites, and there continue in solitude and silence. The cavern of a rock, the darkest part of a hollow tree, the battlements of a ruined and unfrequented castle, some obscure hole in a farmer's out-house, are the places where they are usually found: if they be seen out of these retreats in the daytime, they may be considered as having lost their way; as having by some accident been thrown into the midst of their enemies, and surrounded with danger.

Having spent the day in their retreat, at the approach of evening they sally forth, and skim rapidly up and down along the hedges. The barn-owl, indeed, who lives chiefly upon mice, is contented to be more stationary: he takes his residence upon some shock of corn, or the point of some old house; and there watches in the dark, with the utmost perspicacity and perseverance.

Nor are these birds by any means silent; they all have a hideous note; which, while pursuing their prey, is seldom heard; but may be considered rather as a call to courtship. There is something always terrifying in this call, which

is often heard in the silence of midnight, and breaks the general pause with a horrid variation.¹ It is different in all; but in each it is alarming and disagreeable. Father Kircher, who has set the voices of birds to music, has given all the tones of the owl note, which make a most tremendous melody. Indeed, the prejudices of mankind are united with their sensations to make the cry of the owl disagreeable. The screech-owl's voice was always considered among the people as a presage of some sad calamity that was soon to ensue.

They seldom, however, are heard while they are preying; that important pursuit is always attended with silence, as it is by no means their intention to disturb or forewarn those little animals they wish to surprise. When their pursuit has been successful, they soon return to their solitude, or to their young, if that be the season.² If, however, they find but little game, they continue their quest still longer; and it sometimes happens that, obeying the dictates of appetite rather than of prudence, they pursue so long that broad day breaks in upon them, and leaves them dazzled, bewildered, and at a distance from home.

In this distress they are obliged to take shelter in the first tree or hedge that offers, there to continue concealed all day, till the returning darkness once more supplies them with a better plan of the country. But it too often happens that, with all their precaution to conceal themselves, they are spied out by the other birds of the place, and are sure to receive no mercy. The blackbird, the thrush, the jay, the bunting, and the redbreast, all come in file, and employ their little arts of insult and abuse. The smallest, the feeblest, and the most contemptible of this unfortunate bird's enemies, are then the foremost to injure and torment him. They increase their cries and turbulence round him, flap him with their wings, and are ready to show their courage to be great, as they are sensible that their danger is but small. The unfortunate owl, not knowing where to attack or where to fly, patiently sits and suffers all their insults. Astonished and dizzy, he only replies to their mockeries by awkward and ridiculous gestures, by turning his head and rolling his eyes with an air of stu-

pidity. It is enough that an owl appears by day to set the whole grove into a kind of uproar. Either the aversion all the small birds have to this animal, or the consciousness of their own security, makes them pursue him without ceasing, while they encourage each other by their mutual cries to lend assistance in this laudable undertaking.

It sometimes happens, however, that the little birds pursue their insults with the same imprudent zeal with which the owl himself had pursued his depredations. They hunt him the whole day until evening returns; which restoring him his faculties of sight once more, he makes the foremost of his pursuers pay dear for their former sport. Nor is man always an unconcerned spectator here. The bird-catchers have got an art of counterfeiting the cry of the owl exactly; and having before limed the branches of a hedge, they sit unseen, and give the call. At this, all the little birds flock to the place where they expect to find their well-known enemy; but instead of finding their stupid antagonist they are stuck fast to the hedge themselves. This sport must be put in practice an hour before night-fall, in order to be successful; for if it is put off till later, those birds which but a few minutes sooner came to provoke their enemy, will then fly from him with as much terror as they just before showed insolence.

It is not unpleasant to see one stupid bird made, in some sort, a decoy to deceive another. The great horned owl is sometimes made use of for this purpose to lure the kite, when falconers desire to catch him for the purposes of training the falcon. Upon this occasion they clap the tail of a fox to the great owl, to render his figure extraordinary; in which trim he sails slowly along, flying low, which is his usual manner. The kite, either curious to observe this odd kind of animal, or perhaps inquisitive to see whether it may not be proper for food, flies after, and comes nearer and nearer. In this manner he continues to hover, and sometimes to descend, till the falconer setting a strong-winged hawk against him, seizes him for the purpose of training his young ones at home.

The usual place where the great horned owl breeds is in the cavern of a rock, the hollow of a tree, or the turret of some ruined castle. Its nest is near three feet in diameter, and composed of sticks, bound together by the fibrous roots of trees, and lined with leaves on the inside. It lays about three eggs, which are larger than those of a hen, and of a colour somewhat resembling the bird itself. The young ones are very voracious, and the parents not less expert in satisfying the call of hunger. The lesser owl of this kind never makes a nest for itself, but always takes up with the old nest of some other bird, which it has often been forced to abandon. It lays four or five eggs; and the young are all white at first, but change colour in about a fort-

¹ "I have never," says Mr. C. Waterton, "heard an owl, either in Europe or in America, that utters sounds so nearly resembling the human voice as those which our tawny owl sends forth. Here, where all is still, and everything to be found that is inviting to the feathered race, this bird will hoot at intervals throughout the day, both in cloudy and in sunny weather. Were you to pronounce the letter *O* in a loud and very clear tone of voice, and then, after a short pause, repeat the same letter in a drawling, tremulous accent, you would have a tolerably just idea of the hooting of the tawny owl. It will sometimes produce a sharp cry, which sounds not unlike the word *quo-ah*; both male and female utter this cry."—Ed.

² The common brown owl is known to be in the habit of feeding its young with fish.—Ed.

night. The other owls in general build near the place where they chiefly prey; that which feeds upon birds, in some neighbouring grove; that which preys chiefly upon mice, near some farmer's yard, where the proprietor of the place takes care to give it perfect security. In fact, whatever mischief one species of owl may do in the woods, the barn-owl makes a sufficient recompense for, by being equally active in destroying mice nearer home; so that a single owl is said to be more serviceable than half-a-dozen cats, in ridding the barn of its domestic vermin. "In the year 1580," says an old writer, "at Hallontide, an army of mice so overrun the marshes near Southminster, that they eat up the grass to the very roots. But at length a great number of strange painted owls came and devoured all the mice." The like happened again in Essex about sixty years after.

To conclude our account of these birds, they are all very shy of man, and extremely indocile and difficult to be tamed. The white owl in particular, as Mr. Buffon asserts, cannot be made to live in captivity; I suppose he means, if it be taken when old. "They live," says he, "ten or twelve days in the aviary where they are shut up; but they refuse all kind of nourishment, and at last die of hunger. By day they remain without moving upon the floor of the aviary; in the evening they mount on the highest perch, where they continue to make a noise like a man snoring with his mouth open. This seems designed as a call for their old companions without; and, in fact, I have seen several others come to the call, and perch upon the roof of the aviary, where they made the same kind of hissing, and soon after permitted themselves to be taken in a net.³

³ Mr. Constedt, in the 'Transactions of the Philosophical Society of Stockholm,' has recorded a pleasing instance of their attachment to their young. A young owl having quitted the nest, in the month of July, was caught by his servants, and shut up in a large hen-coop. The next morning a young partridge was found lying dead before the door of the coop. For fourteen successive nights the same circumstance was repeated: plainly proving that it had been brought there by the old owls as a provision for the young one. Till the month of August, various articles of food, as young partridges, moor-fowl, pieces of lamb, and other substances, were regularly brought; after which time the parents discontinued their attendance, and it may be remarked that this is the period when all birds of prey abandon their young to their own exertions.—Ed.

SUPPLEMENTARY NOTE.

In a systematic arrangement, the owls, from their resemblance in form, and alliance in character to the falcon genus, naturally follow them in the order of rapacious birds. The greater part of this genus (*Strix*) are nocturnal, or rather crepuscular birds of prey, sallying forth from their concealed retreats towards the close of day, when other birds are retiring to roost; but when the animals, which form their principal food, are quitting their holes, to feed in expected security during the silence and darkness of

the approaching night. Some of the species are, however, capable of bearing the light of day; these pursue their prey in the same manner as the falcons, and in these also a nearer approach to that genus is observable, in the smaller size of the head, the dimensions of the eye, and the comparative length of the wings and tail.

The eye and ear of the owl are both admirably adapted to its mode of life; in the former, the pupil being capable of great dilatation, and formed, by its particular prominence, for collecting the horizontal and dim rays of twilight; and being also furnished with a strong nictitating membrane, that serves, upon occasion, to defend it from the glare of day, at the same time that it allows the bird to see with sufficient distinctness for avoiding any sudden danger or surprise. The external orifices of the ears are very large and complex, generally furnished with a valve, and situated immediately behind the eyes. In consequence of this formation and disposition, they are alive to the slightest noise, and not even the rustling of a mouse can escape their notice. The flight of the owl, when disturbed during the day, is abrupt and unsteady, but, at night, it skims along in search of its prey with great facility; the delicate and downy texture of its plumage, producing the peculiar buoyancy which must have been generally remarked in the flight of these birds.

The genus is usually divided into two sections; *horned or eared owls*, such as have a tuft of elongated feathers on each side of the forehead, and *smooth-headed owls*, or those destitute of the lengthened feathers. This second section has been subdivided by some authors into a third, called *accipitrine*; but as the gradation from one to another is almost imperceptible, and the characters upon which they have attempted to establish this subdivision are far from being distinct, it is quite sufficient for the general purposes of science to adhere to the twofold division.

The British Fauna enumerates four species in each section, of which two in the eared owls, and three in the smooth-headed, are indigenous; the others are but occasional visitants.

I. HORNED OWLS.

Great-horned or Eagle Owl,	<i>Strix Bubo.</i>
Long-eared Owl,	<i>S. Otus.</i>
Short-eared Owl,	<i>S. Brachyotos.</i>
Little-horned Owl,	<i>S. Scops.</i>

II. SMOOTH-HEADED OWLS.

Snowy Owl,	<i>Strix Nyctea.</i>
Barn Owl,	<i>S. Flammea.</i>
Tawny Owl,	<i>S. Stridula.</i>
Little Owl,	<i>S. Passerina.</i>

Great-horned, or Eagle owl.—This species, which is equal in size to some of the largest eagles, is of very rare occurrence in Great Britain; and, in the few instances on record, the birds can only be regarded as wanderers, or compelled by tempest to cross the Northern ocean. It preys upon fawns, rabbits, the different species of grouse, rats, &c.—It builds amid rocks, or on lofty trees, and lays two or three eggs, larger than those of a hen, round at each end, and of a bluish-white colour. According to Temminck, it is common in Russia, Hungary, Germany, and Switzerland. It is also a native of Africa, and the northern parts of the New World.

Long-eared owl.—The excellent mixture of colours in this bird, and the imposing appearance of its long tufts or ears, render it one of the most interesting of its genus. Though not so numerous as the barn, or the tawny owl, it is found in most of the wooded districts of England and Scotland. Plantations of fir, particularly of the *spruce* kind, are its favourite

haunts, as in these it finds a secure and sheltered retreat during the day. It also frequently inhabits thick holly or ivy bushes, whose evergreen foliage insures a similar retirement. It is an indigenous species, and breeds early in spring; not making any nest of its own, but taking possession of that of a magpie or crow. The eggs are generally four or five in number, white, and rather larger and rounder than those of the ring-dove. When first excluded, the young birds are covered with a fine and closely set white down; they remain in the nest for more than a month before they are able to fly. If disturbed and handled, they hiss violently, strike with their talons, and, at the same time, make a snapping noise with their bills. When they quit the nest, they take up their abode in some adjoining tree, and, for many subsequent days, may be heard, after sunset, uttering a plaintive but loud call for food; during which time the parent birds may be seen diligently employed in hawking for prey. Mice and moles form the principal part of their provender; though Montague says, that they sometimes take small birds on the roost. It is pretty generally diffused throughout Europe; and in North America is found to inhabit the woods at a distance from the sea. It has been observed as far northward as Hudson's Bay. It is 14½ inches in length, and 3 ft. 2 in. from the tip of one wing to that of another.

Short-eared owl.—The birds of this species are only to be met with in England between the months of October and April, as they migrate on the approach of spring to the northern islands of Scotland, where they breed. Mr. Low, in his 'Fauna Orcadensis,' mentions this owl as being very frequent in the hills of Hoy, where it builds its nest amongst the heath. It is there of great boldness, and has been seen to chase pigeons in the open day. In a nest, which contained two full-fledged young ones, he found the remains of a moor-fowl, and two plovers, besides the feet of several others. In this country they generally remain concealed in long grass, or in rushy places, upon waste grounds, or moors. In autumn, they are often met with in turnip fields, but are seldom seen in plantations; nor do they ever attempt to perch upon a tree. Five or six of these birds are frequently found roosting together; from which circumstance it is probable that they migrate in families. Montague thinks that this may arise from the abundance of food they meet with in the places where they are thus collected; but the truth of this supposition may be doubted, from the fact of their being seldom met with during two days together in the same place. The head of this owl being smaller than the generality of its fellow-species, has procured it, in some parts, the name of *hawk-owl*, or *mouse-hawk*. Many ornithologists have been in doubt respecting it, and the synonyms are consequently in some confusion and obscurity. This owl is of wide locality, being met with in Siberia, and in many parts of North America; and specimens are also mentioned as having been brought from the Sandwich Islands.

Scops-eared owl.—This species is very common in the warmer parts of Europe during the summer months, but regularly leaves them on the approach of autumn, for regions near to the equator. In France, it arrives and departs with the swallow. Its favourite residence in Italy, according to Spallanzani, is in the lower wooded regions.—Field and shrew mice, insects, and earth-worms, are its food, in quest of which it sallies forth at nightfall, uttering at the same time its cry, which resembles the word *chivi*, and whence in some districts, it has acquired the name of *Chevini*. It constructs no nest, but deposits five or six eggs in the hollow of a tree.

Snowy owl.—It is only within these few years past, that this noble and beautiful owl has been established as indigenous in Great Britain. In a tour made to

the Orkney and Shetland Isles, in the year 1812, Mr. Bullock, the late proprietor of the London Museum, met with it in both groups of islands; and it is now ascertained that the species is resident, and breeds there. A few years ago a fine specimen was shot near Selby-on-moor in England. It is common in the regions of the arctic circle even inhabiting the frozen coasts of Greenland; is very numerous on the shores of Hudson's Bay, in Norway, Sweden, and Lapland; but of very rare occurrence in the temperate parts of Europe and America.

Barn or White owl.—This is the most common of the British species, and is found in every part of the kingdom. It is an inhabitant of ruins, church-towers, barns, and other buildings, where it is not liable to continual interruption; and is of essential service in checking the breed of the common and shrew mouse, upon which it subsists.—On the approach of twilight it may frequently be seen issuing from its retreat to the adjoining meadows and hedge-banks in search of food, hunting with great regularity, and precipitating itself upon its prey with rapidity and unerring aim. This it swallows whole, and without any attempt to tear it in pieces with its claws. It breeds in old towers, under the eaves of churches, or in similar quiet places, and sometimes in the hollows of trees, laying from three to five eggs, of a bluish white colour. The young, when first from the shell, are covered with white down, and are a long time in becoming fully fledged, or in being able to quit the nest. Like the other species of owls, it ejects the hair, bones, and other indigestible parts of its food, in oval pellets, by the mouth. These castings are often found in great quantities in places where these birds have long resorted. In its flight it occasionally utters loud screams, and when perched, hisses and snores considerably. It is an abundant species throughout Europe and Asia, and Temminck says it is the same throughout North America. It is easily domesticated, and will become very tame when taken young. Montague reared a white owl, a sparrow-hawk, and a ring-dove together, who lived in great harmony for six months. They were then set at liberty; and the owl was the only one of the three that returned.

Tawny owl.—Next to the white or barn owl, the tawny owl is the most abundant of the British species, and is, like the former, generally dispersed throughout the kingdom; but is most readily to be met with in well-wooded districts, as it takes up its abode in woods and thick plantations, preferring those which abound in firs and holly, or ivy bushes. In such situations it remains concealed till night-fall, as it is very impatient of the glare of day, and sees, indeed, imperfectly during that time. It builds in the cavities of old trees, or will occupy the deserted nest of a crow, and produces four or five white eggs, of an elliptical shape. The young, on their exclusion, are covered with a grayish down, and are easily tamed, when fed by the hand; but Montague observes, that if placed out of doors within hearing of their parents, they retain their native shyness, as the old birds visit them at night, and supply them with abundance of food. They prey upon rats, mice, moles, rabbits, and young leverets, and are sometimes destructive to pigeons, entering the dovecots, and committing great havoc. At night this species is very clamorous, and is easily to be known from the others by its hooting, in the utterance of which sounds its throat is largely inflated.

Little owl.—This diminutive species is only an occasional visitant in England, and that but very rarely. According to Temminck, it is never found in Europe beyond the 55th degree of north latitude; but in the warmer regions of this quarter of the globe it is very common.—It inhabits ruins, church-towers, and similar old buildings, and in such it also breeds. The eggs are four or five in number, of a round

shape, and white like those of most of the other species. It is of a wild and fierce disposition, and not capable of being tamed like the little-horned or scops-eared owl. It sometimes preys by day, and,

from having been seen to pursue swallows, must be strong and rapid on the wing. Its prey consists of mice, small birds, and insects.—See *Selby's Ornithology*.

BOOK IV.

OF BIRDS OF THE POULTRY KIND.

CHAP. I.

OF BIRDS OF THE POULTRY KIND IN GENERAL.

FROM the most rapacious and noxious tribe of birds, we make a transition to those which of all others are most harmless, and the most serviceable to man. He may force the rapacious tribes to assist his pleasures in the field, or induce the smaller warblers to delight him with their singing; but it is from the poultry kind that he derives the most solid advantages, as they not only make a considerable addition to the necessaries of life, but furnish out the greatest delicacies to every entertainment.

Almost, if not all, the domestic birds of the poultry kind that we maintain in our yards, are of foreign extraction; but there are others to be ranked in this class that are as yet in a state of nature; and perhaps only wait till they become sufficiently scarce to be taken under the care of man, to multiply their propagation. It will appear remarkable enough, if we consider how much the tame poultry which we have imported from distant climates has increased, and how much those wild birds of the poultry kind that have never yet been taken into keeping have been diminished and destroyed. They are all thinned; and many of the species, especially in the more cultivated and populous parts of the kingdom, are utterly unseen.

Under birds of the poultry kind I rank all those that have white flesh, and, comparatively to their head and limbs, have bulky bodies. They are furnished with short strong bills for picking up grain, which is their chief and often their only sustenance. Their wings are short and concave; for which reason they are not able to fly far. They lay a great many eggs; and, as they lead their young abroad the very day they are hatched, in quest of food, which they are shown by the mother, and which they pick up for themselves, they generally make their nests on the ground. The toes of all these are united by a membrane as far as the first articulation, and then are divided as in those of the former class.

Under this class we may therefore rank the

common cock, the peacock, the turkey, the pintada or Guinea-hen, the pheasant, the bustard, the grouse, the partridge, and the quail. These all bear a strong similitude to each other, being equally granivorous, fleshy, and delicate to the palate. These are among birds what beasts of pasture are among quadrupeds, peaceable tenants of the field, and shunning the thicker parts of the forest, that abound with numerous animals, who carry on unceasing hostilities against them.

As Nature has formed the rapacious class for war, so she seems equally to have fitted these for peace, rest, and society. Their wings are but short, so that they are but ill-formed for wandering from one region to another; their bills are also short, and incapable of annoying their opposers; their legs are strong, indeed, but their toes are made for scratching up their food, and not for holding or tearing it. These are sufficient indications of their harmless nature; while their bodies, which are fat and fleshy, render them unwieldy travellers, and incapable of straying far from each other.

Accordingly we find them chiefly in society; they live together; and though they may have their disputes, like all other animals, upon some occasions, yet when kept in the same district, or fed in the same yard, they learn the arts of subordination; and, in proportion as each knows his strength, he seldom tries a second time the combat where he has once been worsted.

In this manner, all of this kind seem to lead an indolent voluptuous life; as they are furnished internally with a very strong stomach, commonly called a gizzard, so their voraciousness scarcely knows any bounds. If kept in close captivity, and separated from all their former companions, they still have the pleasure of eating left; and they soon grow fat and unwieldy in their prison. To say this more simply, many of the wilder species of birds, when cooped or caged, pine away, grow gloomy, and some refuse all sustenance whatever; none, except those of the poultry kind, grow fat, who seem to lose all remembrance of their former liberty, satisfied with indolence and plenty.

The poultry kind may be considered as sensual epicures, solely governed by their appetites.

The indulgence of these seems to influence their other habits, and destroys among them that conjugal fidelity for which most other kinds are remarkable. The eagle and the falcon, how fierce soever to other animals, are yet gentle and true to each other; their connexions, when once formed, continue till death; and the male and female, in every exigence, and every duty, lend faithful assistance to each other. They assist each other in the production of their young, in providing for them when produced; and even then, though they drive them forth to fight their own battles, yet the old ones still retain their former affection to each other, and seldom part far asunder.

But it is very different with this luxurious class I am now describing. Their courtship is but short, and their congress fortuitous. The male takes no heed of his offspring, and satisfied with the pleasure of getting, leaves to the female all the care of providing for posterity. Wild and irregular in his appetites, he ranges from one to another; and claims every female which he is strong enough to keep from his fellows. Though timorous when opposed to birds of prey, yet he is incredibly bold among those of his own kind; and but to see a male of his own species is sufficient to produce a combat. As his desires extend to all, every creature becomes his enemy that pretends to be his rival.

The female, equally without fidelity or attachment, yields to the most powerful. She stands by a quiet meretricious spectator of their fury, ready to reward the conqueror with every compliance. She takes upon herself all the labour of hatching and bringing up her young, and chooses a place for hatching as remote as possible from the cock. Indeed she gives herself very little trouble in making her nest, as her young ones are to leave it the instant they part from the shell.

She is equally unassisted in providing for her young, that are not fed with meat put into their mouths, as in other classes of the feathered kind, but peck their food, and forsaking their nests, run here and there, following the parent wherever it is to be found. She leads them forward where they are likely to have the greatest quantity of grain, and takes care to show by pecking, the sort proper for them to seek for. Though at other times voracious, she is then abstemious to an extreme degree; and intent only on providing for, and showing her young clutch their food, she scarcely takes any nourishment herself. Her parental pride seems to overpower every other appetite: but that decreases in proportion as her young ones are more able to provide for themselves, and then all her voracious appetites return.

Among the other habits peculiar to this class of birds is that of dusting themselves. They lie flat in some dusty place, and with their wings and feet raise and scatter the dust over their whole body. What may be their reason for thus

doing, it is not easy to explain. Perhaps the heat of their bodies is such, that they require this powder to be interposed between their feathers, to keep them from lying too close together, and thus increasing that heat with which they are incommoded.

CHAP. II.

OF THE COCK.

ALL birds taken under the protection of man lose a part of their natural figure, and are altered, not only in their habits, but their very form. Climate, food, and captivity, are three very powerful agents in producing these alterations; and those birds that have longest felt their influence under human direction are the most likely to have the greatest variety in their figures, their plumage, and their dispositions.

Of all other birds, the cock seems to be the oldest companion of mankind, to have been first reclaimed from the forest, and taken to supply the accidental failure of the luxuries or necessities of life. As he is thus longest under the care of man, so of all others perhaps he exhibits the greatest number of varieties, there being scarce two birds of this species that exactly resemble each other in plumage and form. The tail which makes such a beautiful figure in the generality of these birds, is yet found entirely wanting in others; and not only the tail, but the rump also. The toes, which are usually four in all animals of the poultry kind, yet in a species of the cock are found to amount to five. The feathers, which lie so sleek and in such beautiful order, in most of those we are acquainted with, are, in a peculiar breed, all inverted, and stand staring the wrong way. Nay, there is a species that comes from Japan, which instead of feathers seems to be covered all over with hair. These, and many other varieties, are to be found in this animal, which seem to be the marks this early prisoner bears of his long captivity.

It is not well ascertained when the cock was first made domestic in Europe, but it is generally agreed that we first had him in our western world from the kingdom of Persia. Aristophanes calls the cock the *Persian bird*, and tells us, he enjoyed that kingdom before some of its earliest monarchs. This animal was in fact known so early, even in the most savage parts of Europe, that we are told the cock was one of the forbidden foods among the ancient Britons. Indeed, the domestic fowl seems to have banished the wild one. Persia itself, that first introduced it to our acquaintance, seems no longer to know it in its natural form; and if we did not find it wild in some of the woods of India, as well as those of the islands in the Indian ocean, we might begin to doubt, as we do with regard to the sheep, in

what form it first existed in a state of nature.

But those doubts no longer exist; the cock is found in the island of Tinian, in many others of the Indian ocean, and in the woods on the coast of Malabar, in his ancient state of independence. In his wild condition, his plumage is black and yellow, and his comb and wattles yellow and purple. There is another peculiarity also in those of the Indian woods; their bones which when boiled with us are white, as everybody knows, in those are as black as ebony. Whether this tincture proceeds from their food, as the bones are tintured red by feeding upon madder, I leave to the discussion of others: satisfied with the fact, let us decline speculation.

In their first propagation in Europe, there were distinctions then that now subsist no longer. The ancients esteemed those fowls whose plumage was reddish as invaluable; but as for the white, it was considered as utterly unfit for domestic purposes. These they regarded as subject to become a prey to rapacious birds; and Aristotle thinks them less fruitful than the former. Indeed his division of those birds seems to be taken from their culinary uses: the one sort he calls generous and noble, being remarkable for fecundity; the other sort, ignoble and useless, from their sterility. These distinctions differ widely from our modern notions of generosity in this animal; that which we call the *game-cock* being by no means so fruitful as the ungenerous dunghill cock, which we treat with contempt. The Athenians had their cock-matches as well as we; but it is probable they did not enter into that refinement of choosing out the most barren of the species for the purposes of combat.

However this be, no animal in the world has greater courage than the cock, when opposed to one of his own species; and in every part of the world, where refinement and polished manners have not entirely taken place, cock-fighting is a principal diversion. In China, India, the Philippine islands, and all over the East, cock-fighting is the sport and amusement even of kings and princes. With us it is declining every-day, and it is to be hoped that it will in time become only the pastime of the lowest vulgar. It is the opinion of many, that we have a bolder and more valiant breed than is to be found elsewhere; and some, indeed, have entered into a serious discussion upon the cause of so flattering a singularity. But the truth is, they have cocks in China as bold, if not bolder than ours; and what would still be considered as valuable among cockers here, they have more strength with less weight. Indeed, I have often wondered why men who lay two or three hundred pounds upon the prowess of a single cock, have not taken every method to improve the breed. Nothing, it is probable, could do this more effectually than by crossing the *strain*, as it is called, by a foreign mixture; and whether having recourse even to the wild

cock in the forests of India would not be useful, I leave to their consideration. However, it is a mean and ungenerous amusement, nor would I wish much to promote it. The truth is, I could give such instructions with regard to cock-fighting, and could so arm one of these animals against the other that it would be almost impossible for the adversary's cock to survive the first or second blow; but as Boerhaave has said upon a former occasion, when he was treating upon poisons, "to teach the arts of cruelty is equivalent to committing them."

This extraordinary courage in the cock is thought to proceed from his being the most salacious of all other birds whatsoever. A single cock suffices for ten or a dozen hens; and it is said of him, that he is the only animal whose spirits are not abated by indulgence. But then he soon grows old; the radical moisture is exhausted; and in three or four years he becomes utterly unfit for the purposes of impregnation. "Hens also," to use the words of Willoughby, "as they for the greatest part of the year daily lay eggs, cannot suffice for so many births, but for the most part, after three years become effete and barren: for when they have exhausted all their seed-eggs, of which they had but a certain quantity from the beginning, they must necessarily cease to lay, there being no new ones generated within."

The hen seldom clutches a brood of chickens above once a season, though instances have been known in which they produced two. The number of eggs a domestic hen will lay in the year are above two hundred, provided she be well-fed and supplied with water and liberty. It matters not much whether she be trodden by the cock or no; she will continue to lay, although all the eggs of this kind can never, by hatching, be brought to produce a living animal. Her nest is made without any care, if left to herself; a hole scratched into the ground, among a few bushes, is the only preparation she makes for this season of patient expectation. Nature, almost exhausted by its own fecundity, seems to inform her of the proper time for hatching, which she herself testifies by a clucking note, and by discontinuing to lay. The good housewives, who often get more by their hens laying than by their chickens, artificially protract this clucking season, and sometimes entirely remove it. As soon as their hen begins to cluck, they stint her in her provisions; and if that fails, they plunge her into cold water: this, for the time, effectually puts back her hatching; but then it often kills the poor bird, who takes cold, and dies under the operation.

If left entirely to herself, the hen would seldom lay above twenty eggs in the same nest, without attempting to hatch them: but in proportion as she lays, her eggs are removed; and she continues to lay, vainly hoping to increase the number. In the wild state the hen seldom lays above fif-

teen eggs; but then her provision is more difficultly obtained, and she is perhaps sensible of the difficulty of maintaining too numerous a family.

When the hen begins to sit, nothing can exceed her perseverance and patience; she continues for some days immovable; and when forced away by the importunities of hunger, she quickly returns. Sometimes, also, her eggs become too hot for her to bear, especially if she be furnished with too warm a nest within doors, for then she is obliged to leave them to cool a little: thus the warmth of the nest only retards incubation, and often puts the brood a day or two back in the shell. While the hen sits she carefully turns her eggs, and even removes them to different situations; till at length, in about three weeks, the young brood begin to give signs of a desire to burst their confinement. When, by the repeated efforts of their bill, which serves like a pioneer on this occasion, they have broken themselves a passage through the shell, the hen still continues to sit till all are excluded. The strongest and best chickens generally are the first candidates for liberty; the weakest come behind, and some even die in the shell. When all are produced, she then leads them forth to provide for themselves. Her affection and her pride seem then to alter her very nature, and correct her imperfections. No longer voracious or cowardly, she abstains from all food that her young can swallow, and flies boldly at every creature that she thinks is likely to do them mischief. Whatever the invading animal be, she boldly attacks him; the horse, the hog, or the mastiff. When marching at the head of her little troop, she acts the commander, and has a variety of notes to call her numerous train to their food, or to warn them of approaching danger. Upon one of these occasions I have seen the whole brood run for security into the thickest part of a hedge, when the hen herself ventured boldly forth, and faced a fox that came for plunder. With a good mastiff, however, we soon sent the invader back to his retreat; but not before he had wounded the hen in several places.

Ten or twelve chickens are the greatest number that a good hen can rear and clutch at a time; but as this bears no proportion to the number of her eggs, schemes have been imagined to clutch all the eggs of a hen, and thus turn her produce to the greatest advantage. By these contrivances it has been obtained that a hen, that ordinarily produces but twelve chickens in the year, is found to produce as many chickens as eggs, and consequently often above two hundred. The contrivance I mean is the artificial method of hatching chickens in stoves, as is practised at Grand Cairo; or in a chemical laboratory properly graduated, as has been effected by Mr. Reaumur. At Grand Cairo they thus produce six or seven thousand chickens at a time; where, as they are brought forth in their mild

spring, which is warmer than our summer, the young ones thrive without clutching. But it is otherwise in our colder and unequal climate; the little animal may, without much difficulty, be hatched from the shell; but they almost all perish when excluded. To remedy this, Reaumur has made use of a woollen hen, as he calls it; which was nothing more than putting the young ones in a warm basket, and clapping over them a thick woollen canopy. I should think a much better substitute might be found; and this from among the species themselves. Capons may very easily be taught to clutch a fresh brood of chickens throughout the year; so that when one little colony is thus reared, another may be brought to succeed it. Nothing is more common than to see capons thus employed; and the manner of teaching them is this: first the capon is made very tame, so as to feed from one's hand; then, about evening, they pluck the feathers off his breast, and rub the bare skin with nettles; they then put the chickens to him, which presently run under his breast and belly, and probably rubbing his bare skin gently with their heads allay the stinging pain which the nettles had just produced. This is repeated for two or three nights, till the animal takes an affection to the chickens that have thus given him relief, and continues to give them the protection they seek for: perhaps also the querulous voice of the chickens may be pleasant to him in misery, and invite him to succour the distressed. He from that time brings up a brood of chickens like a hen, clutching them, feeding them, clucking, and performing all the functions of the tenderest parent. A capon once accustomed to this service, will not give over; but when one brood is grown up he may have another nearly hatched put under him, which he will treat with the same tenderness he did the former.

The cock, from his salaciousness, is allowed to be a shortlived animal; but how long these birds live, if left to themselves, is not yet well ascertained by any historian. As they are kept only for profit, and in a few years become unfit for generation, there are few that, from mere motives of curiosity, will make this tedious experiment of maintaining a proper number till they die. Aldrovandus hints their age to be ten years; and it is probable that this may be its extent. They are subject to some disorders, which it is not our business to describe; and as for poisons, besides *nux vomica*, which is fatal to most animals except man, they are injured, as Linnæus asserts, by elder-berries, of which they are not a little fond.

SUPPLEMENTARY NOTE.

This courageous and beautiful bird, now so widely diffused throughout the world, was brought originally from Asia. "As some," says Guillim, "account the eagle the queen, and the swallow or wag-tail the lady, so may I term this the knight amongst

birds, being both of noble courage, and also prepared evermore to the battel, having his comb for an helmet, his sharp and hooked bill for a faulchion or court-lax, to slash and wound his enemy: and as a compleat soldier armed cap-a-pe, he hath his legs armed with spurs, giving example to the valiant soldier to expell danger by fight, and not by flight. The cock croweth when he is victor, and giveth a testimony of his conquest. If he be vanquished, he shunneth the light, and society of men." The fowl we are now considering is finely portrayed in the following lines of Dryden, in his tale of the Nun's Priest:

"More certain was the crowing of the cock
To number hours, than is an abbey clock;
And sooner than the matin bell was rung,
He clapt his wings upon his roost and sung;
For when degrees fifteen ascended right,
By sure instinct he knew 'twas one at night.
High was his comb, and coral-red withal,
In dents embattled like a castle wall;
His bill was raven-black and shone like jet;
Blue were his legs, and orient were his feet;
White were his nails, like silver to behold,
His body glittering like the burnish'd gold."

"Of the several intimations," says Mr. Knapp, "relating to the voice of animals as preserved to us in Scripture, we have none more deserving of attention than the 'crowing of the cock' throughout the night, there being a first crowing about midnight, and a second again as day began to dawn; and this so regularly proceeded in, as to be made use of to mark the progress of time from a very early period, it being pointed out as a well known and established occurrence above eighteen centuries gone by. Though this vociferation of the bird is yet persevered in, it seems to be without any regularity, except, perhaps, the general clamour of the early morning, as in particular nights this crowing may be heard at various intervals during the darkness. Night-travelling birds sound a signal for the guidance of their followers; but these creatures, usually when at rest, or feeding in the gloom, observe a profound silence, and perhaps the cock is the only creature that notifies to any enemy within hearing his asylum on the roost. If such are the habits of these creatures in an unreclaimed state, it must very frequently be productive of injury to them. But in this, his domesticated state, it is a voice which, heard during some sleepless hour, in the deep quiet of the night, becomes most impressive and solemn, brings past events to our recollection, and has, perhaps, often produced holy thoughts and meditations."

The English Supplement to Cuvier affords us the following notices of a few of the varieties or sub-races of the domestic cock.

The crested cock (*Gallus Cristatus*) differs from the domestic, in having an ample tuft of feathers, instead of a fleshy comb, upon the head; but it retains the wattles. Some, indeed, have these replaced by bunches of feathers; and in one—said to be a cross-breed with the cocks of Hamburgh, or perhaps this race itself, for it does not differ from *Cristatus* except in having the eyes surrounded with a circle of feathers—similar plumes, falling back horizontally, cover the ears, the occiput, and sometimes the throat.

The race of crested cocks is particularly in estimation with the curious. It is cultivated with great care; and those who are desirous of propagating any singular varieties of it, isolate certain individuals, and do not suffer them to mingle with others, in which the colours are differently disturbed. Such varieties are more esteemed in proportion as the colours are more rare, or as the tuft contrasts with the rest of the plumage. Though the differences of plumage are thus preserved pretty constant, it is certain that they owe their origin to the same race, and cannot be reproduced in all their purity without the surveillance of man. Sonnini tells us that these

cocks are much esteemed in Egypt, in consequence of the goodness of their flesh. In Upper Egypt they are so common that they are sold at the rate of two-pence or three-pence a-piece. They are equally abundant at the Cape of Good Hope.

The Turkish and Bantam cocks do not differ very materially from our domestic race; and have also much analogy with the Javan species. They resemble each other in size; their tail is not nearly so vertical as in our domestic breed, and they are smaller than our cock. The Bantam cocks differ from the Turkish in the feathers, more or less long, with which the tarsus, and frequently even the toes, are covered. These feathers do not constitute any specific difference; they appear to be simply the effect of superabundant nourishment, with the inseparable consequence of domestication. The same effect, produced by the same causes, is found in many races of the domestic pigeon, which have also the tarsi and feet furnished with feathers, of greater or less length. The races of the Turkish and Bantam cocks are distinguished by a very brilliant plumage, which in the cocks is most generally of a golden lustre. In her Majesty's poultry-house at Windsor there are some fine specimens of the Java bantam. These birds are perfectly white, their habits are in some respects so singular as to demand especial notice. The cocks are so extremely fond of the hens' eggs, that they constantly break and suck them; so strong, indeed, is the appetite, that they have been known to attack the hen, and by repeated pecks, to tear open the ovarium, and eat the shellless eggs. To subdue this extraordinary propensity, her Majesty's poultry-keeper gave the cocks, first a hard-boiled egg, and then a marble one to fight with, taking care at the same time to keep them from any access to a real egg. No sooner was this done than an attack on the false egg was commenced, which lasted for weeks, till at last, wearied with their fruitless labour, they gradually gave up all notice of them, and with that abandonment, as was anticipated, they ceased from their accustomed destruction of the eggs, and have never been known to attack them since. Another remarkable propensity is found in their love of each other's blood. This exhibits itself during the moult, at which time they have been known to peck each other naked, and by plucking out the bulbs of the new-made feathers, to gratify their thirst, in squeezing the blood from the vessels at their base. But this destructive habit being a source of annoyance to her Majesty, has likewise been cured. The keeper, noticing that these birds were subject to great heat of skin, and that occasionally its surface became hard and tightened, bethought himself, that in such cases, the hard roots of the feather, being drawn by the tension into a situation more at right angles with the body than at other times, the action of them on the superficial muscles would become of an irritating and painful nature; and that perhaps the habit of the bird in pecking out the feathers was, after all, nothing more than a provision of nature to save the race from greater evils likely to accrue from a feverish action of the integuments. It then occurred to him, that if these birds were regularly washed in warm water, and their skins well moistened with pomatum, the trouble and its rough treatment would altogether cease. The experiment was tried, and their plumage has never since been disturbed. It may have been inferred by a zoological reader, that these habits would be associated with a custom of *secret* laying on the part of the hen. The case is so. No hen is more secluded in her maternal instincts than the Java bantam. In the hour of her solicitude, she seeks the deepest retirement, and frequently, in her nest, covers herself entirely from sight. This habit has led to the accidental discovery of another very useful regulation in the management

of the poultry-house. The laying nests at Windsor are composed of dry twigs of heather—the *Erica tetralix* of our heaths—and small bramblets of hawthorn, covered over with the lichen *raugiferinus*—the white lichen of our hedges, barn-doors, and park palings. These materials, rubbed together by the motion and pressure of the hen, emitted a light powder, the produce of the crushed leaves; and this, finding its way between the feathers, to the skin, was found to have the immediate effect of discharging the bird of every description of parasite. The Java bantam, which, in a greater degree than other fowl, used the conveniences of the nest, being then found to be the cleanest bird, the cause was, in a short while, attributed to the dust of the nest; and from that time forward all her Majesty's fowls were accommodated with the bed-furniture we have described.

The dwarf cock, though much inferior in size to the other race, is very similar to the common cocks and hens. The legs are in general very short; and the general size varies in different individuals; some are as large as the crow, others do not exceed the pigeon in bulk. The majority have the toes feathered; some sub-races have the comb double, others single; some carry the wings so low that they trail along the ground. The colours of the plumage vary.

There is a multitude more of the races of our domestic cock, whose variations from that species, and from the varieties now described, do not appear of sufficient importance to demand a distinct enumeration. Of those species which may be considered distinct in the genus, are the Jago cock (*Gallus giganteus*). This bird lives in a wild state, in the forests of the southern part of the Island of Sumatra; it is also found in the western portions of the Island of Java. Dampier and Marsden have noticed it. The last, who speaks of it very succinctly, says, that he saw a cock of this species, which standing on the floor of an apartment, reached easily to the dinner-table with his bill; when this bird was fatigued, he rested himself on the first articulation of the leg, and, even then, was taller than our domestic cock. From this cock, and from the *Banhuia*, another primitive cock, found in the island of Java, M. Temminck considers our common cock to have originated.

The Paduan cocks, and the hens of Sansevarre (*Gallus Patavinus*), seem to approach the nearest to this Jago species, and may be considered as varieties or descendants of it. This race is almost double the size of our domestic cocks and hens; their voice is strong and hoarse; and the weight is eight or ten pounds. To this race may also be referred the great cocks of Rhodes, of Persia, and of Pegu; and the large hens of Bahia, mentioned by Dampier. Among other species of the cock are—the wild cock of Sonnerat—the negro cock, so called from its black crest—the silk cock—the crisped cock, &c.—all inhabitants of Asia. The Cochinchina fowls are of gigantic size, and in their proportions very nearly allied to the family of bustards, to which in all probability they are proximately related—in fact, they have acquired the name of 'the ostrich fowl.' In general colour they are of a rich glossy brown; tail black, and on the breast a horse-shoe marking of black: the comb cleanly and neatly formed, with shallow serrations; the wattles double. Two characters appear to be peculiar to them—one, the arrangement of the feathers on the back of the cock's neck, which are turned upwards; and the other the form of the wing, which is jointed to fold together, so that, on occasion, the bird may double up its posterior half and bring it forward between the anterior half and the body. The eggs are of a deep mahogany colour, and of a delicious flavour.

CHAP. III.

OF THE PEACOCK.

THE Peacock, by the common people of Italy, is said to have the plumage of an angel, the voice of a devil, and the guts of a thief. In fact, each of these qualities marks pretty well the nature of this extraordinary bird. When it appears with its tail expanded, there is none of the feathered creation can vie with it for beauty; yet the horrid scream of its voice serves to abate the pleasure we find from viewing it: and still more its insatiable gluttony, and spirit of depredation, make it one of the most noxious domestics that man has taken under his protection.

Our first peacocks were brought from the East Indies; and we are assured that they are still found in vast flocks, in a wild state, in the islands of Java and Ceylon. So beautiful a bird, and one esteemed such a delicacy at the tables of the luxurious, could not be permitted to continue long at liberty in its distant retreats. So early as the days of Solomon, we find in his navies, among the articles imported from the east, apes and peacocks. Elian relates, that they were brought into Greece from some barbarous country, and were held in such high esteem among them, that a male and female were valued at above thirty pounds of our money. We are told also, that when Alexander was in India, he found them flying wild in vast numbers, on the banks of the river Hyarotis, and was so struck with their beauty, that he laid a severe fine and punishment on all who should kill or disturb them. Nor are we to be surprised at this, as the Greeks were so much struck with the beauty of this bird, when first brought among them, that every person paid a fixed price for seeing it; and several people came to Athens, from Lacedæmon and Thessaly, purely to satisfy their curiosity.¹

¹ The late Baron Ternaux, says an anonymous writer, decorated his grounds at St. Ouen, near Paris, with splendid looking-glasses, which reflected the varied landscape, and produced a very fine effect. One day the gardener found one of the peafowls before the glass, with its tail displayed, and apparently contemplating itself with great satisfaction. The gardener let it remain there until he went round the grounds; he returned in a few hours, and found the peacock still before the glass. He now drove it away, but it as constantly returned. He at length took it to the aviary; but the peacock, as soon as it could get out, went back to the mirror, refusing all food for the delight of beholding itself in the glass. The baron at last suffered it to remain, ordering food to be placed before it near the glass; but it did not touch it: and, on the third or fourth day, the bird of Juno was found lying dead before the glass. A second peacock, which had never seen the mirror, was brought, that it might be observed whether the effect would be the same; when it was found that it was as proud of viewing its own image as its predecessor; and, to prevent its meeting a similar fate, it was not allowed access to the grounds. The above anecdote was communicated to the narrator by

It was probably first introduced into the West merely on account of its beauty; but mankind, from contemplating its figure, soon came to think of serving it up for a different entertainment. Aufidius Hurco stands charged by Pliny with being the first who fattened up the peacock for the feast of the luxurious. Whatever there may be of delicacy in the flesh of a young peacock, it is certain an old one is very indifferent eating; nevertheless, there is no mention made of choosing the youngest; it is probable they were killed indiscriminately, the beauty of the feathers in some measure stimulating the appetite. Hortensius the orator was the first who served them up at an entertainment at Rome; and from that time they were considered as one of the greatest ornaments of every feast. Whether the Roman method of cookery, which was much higher than ours, might not have rendered them more palatable than we find them at present, I cannot tell; but certain it is, they talk of the peacock as being the first of viands.

Its fame for delicacy, however, did not continue very long; for we find in the times of Francis the First, that it was a custom to serve up peacocks at the tables of the great, with an intention not to be eaten, but only to be seen. Their manner was to strip off the skin; and then preparing the body with the warmest spices, they covered it up again in its former skin, with all its plumage in full display, and no way injured by the preparation. The bird thus prepared was often preserved for many years without corrupting; and it is asserted of the peacock's flesh, that it keeps longer unputrified than that of any other animal. To give a higher zest to these entertainments, on weddings particularly, they filled the bird's beak and throat with cotton and camphire, which they set on fire, to amuse and delight the company. I do not know that the peacock is much used at our entertainments at present, except now and then at an alderman's dinner, or common-council feast, when our citizens resolve to be splendid; and even then it is never served with its cotton and camphire.

Like other birds of the poultry kind, the peacock feeds upon corn, but its chief predilection is for barley. But as it is a very proud and fickle bird, there is scarcely any food that it will not at times covet and pursue. Insects and tender plants are often eagerly sought at a time that it has a sufficiency of its natural food provided more nearly. In the indulgence of these capricious pursuits walls cannot easily confine it; it strips the tops of houses of their tiles or thatch, it lays waste the labours of the gardener, roots up his choicest seeds, and nips his favourite

the baron himself, on his last visit to London. The same phenomenon has been observed in other kinds of birds, as goldfinches, turkeys, &c.; in some cases the idea of the presence of a companion must be the dominant feeling.—Ed.

flowers in the bud. Thus its beauty but ill recompenses for the mischief it occasions; and many of the more homely-looking fowls are very deservedly preferred before it.²

Nor is the peacock less a debauchee in its affections than a glutton in its appetites. He is still more salacious than even the cock; and though not possessed of the same vigour, yet burns with more immoderate desire. He requires five females at least to attend him; and if there be not a sufficient number, he will even run upon and tread the sitting hen. For this reason, the peahen endeavours as much as she can to hide her nest from the male, as he would otherwise disturb her sitting, and break her eggs.

The peahen seldom lays above five or six eggs in this climate before she sits. Aristotle describes her as laying twelve; and it is probable, in her native climate she may be thus prolific; for it is certain, that in the forests where they breed naturally, they are numerous beyond expression. This bird lives about twenty years; and not till its third year has it that beautiful variegated plumage that adorns its tail.

"In the kingdom of Cambaya," says Tavernier, "near the city of Baroch, whole flocks of them are seen in the fields. They are very shy, however, and it is impossible to come near them. They run off swifter than the partridge; and hide themselves in the thickets, where it is impossible to find them. They perch by night upon trees; and the fowler often approaches them at that season with a kind of banner, on which a peacock is painted to the life on either side. A lighted torch is fixed on the top of this decoy; and the peacock when disturbed flies to what it takes for another, and is thus caught in a noose prepared for that purpose."

There are varieties of this bird, some of which are white, others crested; that which is called the Peacock of Thibet, is the most beautiful of the feathered creation, containing in its plumage all the most vivid colours, red, blue, yellow, and green, disposed in an almost artificial order, as if merely to please the eye of the beholder.

² An opinion prevails in some parts of England that the peacock is the natural enemy of the serpent tribe. A peacock was observed to remain for several days near to a hotbed frame in the garden at Raynall, and to make frequent attempts to break the glass of the frame with his beak, and, although he was repeatedly driven away from it, he as constantly returned to it again as soon as the gardener had left the spot. This circumstance at length attracted the attention of the late Mr. Sykes (M. P. for Hull), who caused the frame to be removed, when the peacock instantly leaped into the bed, scratched away some part of the manure, under which he found a nest containing several young serpents, all of which he, with some assistance, instantly killed and devoured.—Ed.

SUPPLEMENTARY NOTE.

The Japan peacock is only known to Europe by means of a painting sent by the emperor of Japan to

the pope. It is about the size of the crested peacock; but the bill is larger, and ash-coloured; the iris yellow, and round the eye is red. On the top of the head is an upright crest four inches long, and shaped somewhat like an ear of corn. The colour is green mixed with blue. The top of the neck and head greenish, marked with spots of blue; the breast is blue and green-gold mixed; the belly, sides, and thighs are ash-colour, marked with black spots, streaked with white on the belly; the wing-coverts and secondaries are not unlike the back; the greater quills are green, transversely barred with black lines, but growing yellowish towards the ends, where they are black; the upper tail-coverts are fewer than those of the common peacock, but much longer than the tail; they are of a chestnut brown with white shafts, and have at the end of each a large spot gilded in the middle, then blue, and surrounded with green; the legs are ash-coloured, and not furnished with spurs. The female of this species is smaller than the male, and differs in having the belly quite black, and the upper tail-coverts much shorter.

The Chinese peacock is larger than the common peacock: the bill is black, but from the nostrils to the tip of the upper mandible red: the iris is yellow. The feathers on the crown of the head are sufficiently long to form a crest of a dull brown colour. The space between the bill and thighs is naked, with a few scattered hairs; the sides of the head are white; the neck is bright brown, striated across with dusky brown; the upper parts of the back, scapulars, and wing-coverts are dull brown, dotted with paler brown, and yellowish; besides which each feather is marked near the end with a roundish large spot of a gilded purple colour, changing into blue and green in different lights; the lower part of the back is dotted with white; all the under parts are brown, striated transversely with black; the quills are dusky; the secondaries are marked with the same spots as the rest of the wing; the upper tail-coverts are longer than the tail, and marked at the end with a spot like the wing feathers, each of which is surrounded first with a circle of black, and ultimately with an orange one; the legs and claws are brown; and on the back part of each leg are two spurs, one above the other. The female is a third smaller than the male. The head, neck, and under parts are brown; the head smooth; the upper parts are also brown, and the feathers marked with a dull blue spot surrounded with dirty orange; the feathers which cover the tail are similar, but marked at the end with an obscure dull oval spot of blue; the legs have no spurs.

The Thibet peacock is about two feet and two inches long. The bill is above an inch and a half long, and cinereous; the iris yellow; the head, neck, and under parts are ash-coloured, marked with blackish lines; the wing-coverts, back, and rump, are gray, with small white dots; besides which, on the wing-coverts and back are large round spots, of a fine blue, changing in different lights to violet and green gold; the quills and upper tail-coverts are also gray, marked with blackish lines; the quills have two round blue spots on each, like those of the coverts; on the outer webs and on each tail feather, there are four of the same, two on each side of the web; the middle coverts are the longest, the others shorten by degrees; the legs are gray, furnished with two spurs behind; the claws are blackish. This bird is a native of the kingdom of Thibet, in Asia.

CHAP. IV.

THE TURKEY.

THE natal place of the cock and the peacock is pretty well ascertained, but there are stronger doubts concerning the turkey; some contending that it has been brought into Europe from the East Indies many centuries ago: while others assert that it is wholly unknown in that part of the world, that it is a native of the new continent, and that it was not brought into Europe till the discovery of that part of the world.

Those who contend for the latter opinion very truly observe, that among all the descriptions we have of eastern birds, that of the turkey is not to be found; while, on the contrary, it is very well known in the new continent, where it runs wild about the woods. It is said by them to have been first seen in France in the reign of Francis I., and in England in that of Henry VIII., which is about the time when Mexico was first conquered by Spain.¹ On the other hand it is asserted, that the turkey, so far from being unknown in Europe before that time, was known even to the ancients; and that Ælian has given a pretty just description of it. They allege, that its very name implies its having been brought from some part of the east; and that it is found among other dainties served up to the tables of the great, before that time among ourselves. But what they pretend to be the strongest proof is, that though the wild turkey be so numerous in America, yet the natives cannot contrive to tame it; and though hatched in the ordinary manner, nothing can render it domestic. In this diversity of opinions, perhaps it is best to suspend assent till more lights are thrown on the subject: however, I am inclined to concur with the former opinion.²

With us, when young, it is one of the tenderest of all birds; yet, in its wild state it is found in great plenty in the forests of Canada, that are covered with snow above three parts of the year. In the natural woods they are found much larger than in their state of domestic captivity. They are much more beautiful also, their feathers being of a dark gray, bordered at the edges with a bright gold colour. These the savages of the country weave into cloaks to adorn their persons, and fashion into fans and umbrellas, but never once think of taking into keeping animals that the woods furnish them with in sufficient abundance. Savage man seems to find a delight in precarious possession. A great part of the pleasures of the chase lies in the uncertainty of the pursuit, and he is unwilling to abridge him-

¹ It was about the year 1570 that this bird began to form one of the usual articles of a Christmas feast in England.—ED.

² It is now universally allowed, that the turkey is originally a native of North America.—ED.

self in any accidental success that may attend his fatigues. The hunting the turkey, therefore, makes one of his principal diversions; as its flesh contributes chiefly to the support of his family. When he has discovered the place of their retreat, which in general is near fields of nettles, or where there is plenty of any kind of grain, he takes his dog with him, which is trained to the sport, (a faithful rough creature, supposed to be originally reclaimed from the wolf,) and he sends him into the midst of the flock. The turkeys no sooner perceive their enemy, than they set off running at full speed, and with such swiftness, that they leave the dog far behind them; he follows, nevertheless, and sensible they must soon be tired, as they cannot go full speed for any length of time, he at last forces them to take shelter in a tree, where they sit quite spent and fatigued till the hunter comes up, and, with a long pole, knocks them down, one after the other.

This manner of suffering themselves to be destroyed, argues no great instinct in the animal; and, indeed, in their captive state they do not appear to be possessed of much. They seem a stupid, vain, querulous tribe, apt enough to quarrel among themselves, yet without any weapons to do each other an injury. Everybody knows the strange antipathy the turkey-cock has to a red colour; how he bristles, and, with his peculiar gobbling sound, flies to attack it.—But there is another method of increasing the animosity of these birds against each other, which is often practised by boys, when they have a mind for a battle. This is no more than to smear over the head of one of the turkeys with dirt, and the rest run to attack it with all the speed of impotent animosity; nay, two of them, thus disguised, will fight each other till they are almost suffocated with fatigue and anger.

But though so furious among themselves, they are weak and cowardly against other animals, though far less powerful than they. The cock often makes the turkey keep at a distance; and they seldom venture to attack him but with united force, when they rather oppress him by their weight than annoy him by their arms. There is no animal, how contemptible soever, that will venture boldly to face the turkey-cock, that he will not fly from. On the contrary, with the insolence of a bully, he pursues any thing that seems to fear him, particularly lapdogs and children, against both which he seems to have a peculiar aversion. On such occasions, after he has made them scamper, he returns to his female train, displays his plumage around, struts about the yard, and gobbles out a note of self-approbation.

The female seems of a milder, gentler disposition. Rather querulous than bold, she hunts about in quest of grain, and pursuit of insects, being particularly delighted with the eggs of ants and caterpillars. She lays eighteen or twenty

eggs, larger than those of a hen, whitish, but marked with spots resembling the freckles of the face. Her young are extremely tender at first, and must be carefully fed with curd chopped with dock-leaves; but as they grow older, they become more hardy, and follow the mother to considerable distances, in pursuit of insect food, which they prefer to any other. On these occasions, however, the female, though so large, and, as it would seem, so powerful a bird, gives them but very little protection against the attacks of any rapacious animal that comes in her way. She rather warns her young to shift for themselves, than prepares to defend them. "I have heard," says the Abbe la Pluche, "a turkey-hen, when at the head of her brood, send forth the most hideous screams, without knowing as yet the cause: however, her young, immediately when the warning was given, skulked under the bushes, the grass, or whatever else offered for shelter or protection. They even stretched themselves at their full length upon the ground, and continued lying as motionless as if they were dead. In the meantime the mother, with her eyes directed upwards, continued her cries and screaming as before. Upon looking up to where she seemed to gaze, I discovered a black spot just under the clouds, but was unable at first to determine what it was; however, it soon appeared to be a bird of prey, though at first at too great a distance to be distinguished. I have seen one of these animals continue in this violent agitated state, and her whole brood pinned down as it were to the ground, for four hours together; whilst their formidable foe has taken his circuits, has mounted, and hovered directly over their heads: at last, upon disappearing, the parent began to change her note, and sent forth another cry, which in an instant gave life to the whole trembling tribe, and they all flocked round her with expressions of pleasure, as if conscious of their happy escape from danger."

When once grown up, turkeys are very hardy birds, and feed themselves at very little expense to the farmer. Those of Norfolk are said to be the largest of this kingdom, weighing from twenty to thirty pounds. There are places, however, in the East Indies, where they are known only in their domestic state, in which they grow to the weight of sixty pounds.

NOTE A.—Of the Turkey.

The wild turkeys are much more bulky than the domestic turkeys, weighing from twenty even to sixty pounds. Their plumage is always of a uniform deep brown; all the feathers are slightly undulated with very delicate traits of brown. The males exhibit varying tints which give splendour to the plumage. The wild turkeys fly in numerous flocks of many hundreds. They frequent woods and coppices during the day, where they feed on acorns. They return in the evening into marshes, where they pass the night. They perch on trees, and are not unfrequently hunted with hounds. Wild turkeys are found from the country of the Illinois, as far as

the isthmus of Panama. The birds which travellers have met more to the southward, and mistaken for turkeys, are boccos. They live for the most part in forests, and feed on wild fruits: the acorn of the green oak fattens them very much. Their flesh is preferable to that of the domestic breed, and its flavour approaches to that of the pheasant. These birds quit the woods in the month of September, and approach inhabited places; accordingly, the natives of North America call this season the *turkey month*. They then hunt them, and kill great numbers, which are preserved in ice, and brought into the European establishments. The wild turkeys are now to be met with only very far in the interior. They are extremely shy, and though their flight is heavy, they know so well how to escape and conceal themselves, that they are discovered with difficulty. Those that are brought up in their native country, and which lead a rural life, and are never shut up, have yet become as degenerate as those of our poultry-yards in Europe.

The turkey is unquestionably the largest of our poultry. Its usual length is three feet and a half, from the end of the bill to the extremity of the tail. Its height, about two feet, measuring from the soles to the summit of the head. The envergure is about four feet. Turkey-hens are far from being as profitable, generally speaking, as our common hens. They have need of stimulating food, to excite them to lay, such as hempseed and buck-wheat. They have, however, two broods usually in the year, of about fifteen eggs, often less, especially in northern climates. The eggs are white, with some small spots of reddish yellow. The young ones in coming forth from the egg are very weak, and most assiduous care is requisite for the preservation of their existence. The strong sun kills them almost immediately. The frost gives them cold; but it is chiefly in wet weather that it is necessary to shelter them, without which they are certain to perish. Even the dew is pernicious to them. An elevated situation, and a dry sandy soil, suit them best; and even there, it requires exceeding attention to turn them to any profit.

Turkeys are polygamous, and a single cock suffices for twelve or fifteen females. These females will serve for about five years, but the hens of two and three years old hatch most assiduously. Those of but one year do not pay sufficient attention to their brood. The strongest and largest should always be chosen for this purpose. It happens more frequently with them than with hens that the eggs are sterile. In the cold parts of Europe, the female turkey has but one brood in the year, which usually takes place in March or April; but in countries exposed to a milder temperature, she has two: the first in February, the second in August.

NOTE B.—Of the Curassows.

A great variety of gallinaceous birds, which might easily be added to our domestic poultry, are peculiar to America. Such are especially the curassows. In many parts of South America these birds have long been reclaimed; and it is really surprising, considering the extreme familiarity of their manners, and the facility with which they appear to pass from a state of nature to the tameness of domestic fowls, that they have not yet been introduced to the poultry-yards of Europe. That, with proper treatment, they would speedily become habituated to the climate we have no reason to doubt; on the contrary, numerous examples have shown that they thrive well even in its northern parts; and M. Temminck informs us that they have once at least been thoroughly acclimated in Holland, where they were as prolific, in their domesticated state, as any of our common poul-

try. The establishment, however, in which this had been effected, was broken up by the civil commotions which followed in the train of the French revolution, and all the pains which had been bestowed upon the education of these birds were lost to the world by their sudden and complete dispersion. The task, which had at that time been in some measure accomplished, still remains to be performed; and it may not be too much to expect that the Zoological Society may be successful in perfecting what was then so well begun, and in naturalizing the curassows as completely as our ancestors have done the equally exotic, and, in their wild state, much less familiar, breeds of the turkey, the guinea-fowl, and the peacock. Their introduction would certainly be most desirable, not merely on account of their size and beauty, but also for the whiteness and excellence of their flesh, which is said by those who have eaten of it to surpass that of the guinea-fowl or of the pheasant in the delicacy of its flavour.

The plumage of the crested curassow is of a deep black with a slight gloss of green upon the head, crest, neck, back, wings, and upper part of the tail; and dull white beneath and on the lower tail-coverts. Its crest is from two to three inches in length, and occupies the whole upper surface of the head: it is curled and velvety in its appearance, and capable of being raised or depressed at will, in accordance with the temporary feelings by which the bird is actuated. The eyes are surrounded by a naked skin, which extends into the cere and there assumes a bright yellow colour. In size the bird is almost equal to a turkey. This species is a native of Mexico, Guiana, and Brazil, and probably extends itself over a large portion of the southern division of the American continent. In the woods of Guiana it appears to be so extremely common that M. Sonnini regards it as the most certain resource of a hungry traveller, whose stock of provisions is exhausted, and who has consequently to trust to his gun for furnishing him with a fresh supply. They congregate together in numerous flocks, and appear to be under little or no uneasiness from the intrusion of men into their haunts. Even when a considerable number of them have been shot, the rest remain quietly perched upon the trees, apparently unconscious of the havoc that has been committed among them. This conduct is by no means the result of stupidity, but proceeds rather from the natural tameness and unsuspiciousness of their character. Those, however, which frequent the neighbourhood of inhabited places are said to be much wilder and more mistrustful, being kept constantly on the alert to avoid the pursuit of the hunters who destroy them in great numbers. They build their nests on the trees, forming them externally of branches interlaced with the stalks of herbaceous plants, and lining them internally with leaves. They generally lay but once a-year, during the rainy season; the number of their eggs being, according to Sonnini, five or six, and to D'Azara as many as eight. They are nearly as large as those of a turkey, but are white like a hen's, and with a thicker shell.

The galeated curassow is in size about equal to the crested curassow. Its head and neck are covered with short black velvety feathers; and all the rest of the plumage, with the exception of the white abdomen, and under tail-coverts, is of a brilliant black, exhibiting, in certain positions, a slight tinge of green. The tail-feathers are tipped with white. The legs are red; the claws yellow; the iris brown. The bill is of a bright red; and the protuberance by which it is surmounted (which is rounded in the young birds, and pear-shaped with the narrow end directed forwards in adult males), is of a livid slate-colour. This remarkable projection is more than two inches in length when fully developed; it is hard

and bony externally, and internally cellular, the cells communicating with the cavity of the mouth. It is not visible until after the first moulting, when it begins to make its appearance in the form of a small tubercle, and attains a much larger size in the male than in the female. In other respects there is little difference between the sexes; and the young are only distinguished by a browner tinge. The windpipe descends for a considerable distance in front of the sternum, immediately beneath the skin, and makes no less than three distinct convolutions before passing into the cavity of the chest. These birds are natives of Mexico, and live in large bands, perching upon the trees, but more commonly building their nests upon the ground. The females lead their young about in the same manner as the hen pheasant or the common hen. They subsist at first upon worms and insects; but as they grow older they add to these animal productions the fruits and seeds of vegetables. They are easily domesticated, even when taken adult; and appear to be equally capable of being acclimated in Europe with any of the other species. M. Temminck enumerates them among the birds which bred abundantly in the menagerie of M. Ameshoff prior to the breaking out of the French revolution.

The razor-billed curassow's most distinctive character consists in the form of the horny process that surmounts its bill, which rises above the level of the head, is flattened on the sides, runs anteriorly into a sharp edge, spreads out at the base where it is continuous with the bill, and is like it of a bright red. The whole of the upper parts, the fore part of the neck, the breast, and the legs, are black with a violet or purple gloss. The tail is of the same colour for the greater part of its length, but terminates in a white band; and the extreme part of the belly is of a chestnut brown. Above the base of the bill, which is covered with short velvety feathers concealing the nostrils, is a tuft of straight feathers; the iris is dusky, and the naked legs are reddish brown. In the young bird the horny process of the bill is smaller, and less intensely red. It has not yet been attempted to naturalize the present species in this quarter of the globe; but its flesh, according to Maregrave, in whatever mode prepared, but especially when roasted, yields to that of no bird, either of Europe or America. He adds that it is domesticated and cultivated by the gentry of Brazil, on account of both its dignity and elegance.

The guan is of the same family with the curassows, and closely allied to those birds both in structure and general appearance. It is nevertheless distinguished by several remarkable peculiarities. The bill is much shallower, its transverse diameter exceeding its depth, somewhat elongated, and naked at the base; the nostrils are placed about the middle of the bill, and are not at all concealed by the advancement of the feathers of the head; a naked space surrounds the eyes; the skin of the throat is destitute of feathers, and capable of considerable distension; the claws are strong, curved, and pointed; and the hinder toe is articulated on the same level with the anterior ones, and consequently applies its whole length to the surface of the ground. As in the other genera of the family, the bill is convex above and curved at the point; the legs are of moderate length and without spurs; the wings short, with the sixth quill-feather longest; and the tail flat, rounded at the extremity, and formed of twelve broad feathers. From its long domestication in the poultry-yards of South America, it is subject to very extensive variations. It is the largest bird of the genus that has yet been discovered, measuring when fully grown about thirty inches in total length, of which the tail constitutes thirteen or fourteen. The whole upper surface of the body is of a dusky black or bronze

colour with a gloss of green, which becomes olive in certain positions with regard to light.

Like most of the birds of this family, the guan is remarkable for the circuitous course of its windpipe before entering the cavity of the chest. It has also some peculiarities in the structure of its upper larynx, which are well described by M. Temminck in his natural history of gallinaceous birds, published at Amsterdam in 1815. The manners of the guan have little to distinguish them from those of the curassows. Although to all appearance equally capable of domestication, they have not yet been introduced into Europe in equal numbers with the latter birds, nor has the same success attended the attempts to propagate them in this quarter of the globe. We are told, however, by M. Temminck, that the proprietor of a menagerie in the neighbourhood of Utrecht had bred them for several years; and there can be little doubt that with proper care and attention these birds might be added to the stock of our domesticated fowls. They are spoken of as furnishing an excellent dish for the table. In a wild state they inhabit Guiana and Brazil, and perhaps extend still further to the north. Their food consists principally of seeds and fruits, which they search for and eat upon the ground; but the greater part of their existence is passed upon the trees, on the tops of which they perch, and in which they build their nests. They are not often found in large bands, but generally pair together with the strictest constancy. The females lay from two to five eggs. Their flight, like that of most gallinaceous birds, in consequence of the shortness of their wings, is low and heavy; and in the performance of this action they derive much assistance from their tail, the feathers of which may be expanded in the shape of a fan.

All the birds of this genus appear to be known in Brazil by the name of Jacu, pronounced Yacou, derived, according to Maregrave, from their note. This, as might be expected from the conformation of their trachea, is extremely loud, insomuch that when a considerable number are collected near the same spot, the very woods, to use the expression of the scientific traveller just quoted, re-echo with their clamorous cries.

CHAP. V.

THE PHEASANT.

It would surprise a sportsman to be told, that the pheasant which he finds wild in the woods, in the remotest parts of the kingdom, and in forests which can scarcely be said to have an owner, is a foreign bird, and was at first artificially propagated amongst us. They were brought into Europe from the banks of the Phasis, a river of Colchis, in Asia Minor; and from whence they still retain their name.

Next to the peacock, they are the most beautiful of birds, as well for the vivid colour of their plumes as for their happy mixtures and variety. It is far beyond the power of the pencil to draw anything so glossy, so bright, or points so finely blended into each other. We are told that when Croesus, king of Lydia, was seated on his throne, adorned with royal magnificence, and all the barbarous pomp of eastern splendour, he asked Solon if he had ever beheld any thing so fine?

The Greek philosopher, no way moved by the objects before him, or taking a pride in his native simplicity, replied, that after having seen the beautiful plumage of the pheasant, he could be astonished at no other finery.

In fact, nothing can satisfy the eye with a greater variety and richness of ornament than this beautiful creature. The iris of the eye is yellow; and the eyes themselves are surrounded with a scarlet colour, sprinkled with small specks of black. On the fore-part of the head there are blackish feathers mixed with a shining purple. The top of the head and the upper part of the neck are tinged with a darkish green, that shines like silk. In some, the top of the head is of a shining blue, and the head itself, as well as the upper part of the neck, appears sometimes blue and sometimes green, as it is differently placed to the eye of the spectator. The feathers of the breast, the shoulders, the middle of the back, and the sides under the wings, have a blackish ground, with edges tinged of an exquisite colour, which appears sometimes black and sometimes purple, according to the different lights it is placed in; under the purple there is a transverse streak of gold colour. The tail, from the middle feathers to the root, is about eighteen inches long; the legs, the feet, and the toes, are of the colour of horn. There are black spurs on the legs, shorter than those of a cock; there is a membrane that connects two of the toes together; and the male is much more beautiful than the female.¹

¹ A remarkable physiological fact respecting the plumage of female birds,—that many of them assume somewhat the character of the male when they become aged,—is frequently illustrated in the case of the pheasant. The late Mr. John Wilson, janitor and stuffer to the Edinburgh college museum, during the course of his experience had through his hands upwards of fifty hen-pheasants which had assumed the male plumage. Dr. Butter of Plymouth has satisfactorily proved, that our domestic female fowls have all a tendency to assume the male plumage at an advanced period of their lives, so as to make them resemble the cock of their own species. In illustration he states, that "Mr. Corham, at Compton, near Plymouth, has, for a long series of years, possessed an excellent breed of game-fowls, the cocks of which are of a beautiful dark-red colour, and the hens of a dusky brown. One hen of this breed was allowed to live as long as possible, because her chickens became so renowned in the cock-pit. When, however, she had attained the age of fifteen years, she was observed, after moulting, to have acquired some arched cock's feathers in her tail, whilst others (old feathers) remained straight and brown as formerly. By degrees, and during one moulting season, the whole of her dusky plumage was thrown off and succeeded by a covering of red, and more beautiful feathers, quite like those of a cock of her own breed. In the course of a single season, the change was so fully accomplished, that as she walked about any stranger might have pronounced her rather a cock than a hen. Spurs, likewise, sprouted out on her legs, she acquired a comb and wattles on her head; and even crowed hoarsely not unlike a young cock. Her wattles were, however, cut off afterwards, for the

This bird, though so beautiful to the eye, is not less delicate when served up to the table. Its flesh is considered as the greatest dainty; and when the old physicians spoke of the wholesomeness of any viands, they made their comparison with the flesh of the pheasant. However, notwithstanding all these perfections to tempt the curiosity or the palate, the pheasant has multiplied in its wild state; and, as if disdaining the protection of man, has left him to take shelter in the thickest woods and the remotest forests. All others of the domestic kind, the cock, the turkey, or the pintada, when once reclaimed, have still continued in their domestic state, and persevered in the habits and appetites of willing slavery. But the pheasant, though taken from its native warm retreats, where the woods supply variety of food, and the warm sun suits its tender constitution, has still continued its attachment to native freedom; and now wild among us, makes the most envied ornament of our parks and forests, where he feeds upon acorns and berries, and the scanty produce of our chilling climate.²

purpose of making her like a fighting cock. After the completion of this change of plumage, she discontinued to lay eggs; and lived no very considerable time to enjoy her recently acquired, but splendid costume."

Among the facts of the female bird assuming the plumage of the male, recorded by authors, are the following; the pea-hen, by Hunter; the turkey, by Bechstein; the common pheasant, by Hunter; but of this we have of late had innumerable instances; the golden pheasant, by Blumenbach; the domestic fowl, by Aristotle, Tucker, and Butter; the partridge, by Montague; the pigeon, by Tiedmann; the bustard, by Tiedmann; the American pelican, by Catesby; the common wild-duck, by Tiedmann. Some years ago, a female golden-pheasant, in the possession of the duke of Buccleugh, assumed the male plumage. Mr. Falconer of Carlowrie, knew an instance of a domestic duck assuming the garb of the drake; and a nobleman in Devonshire had a female wild duck, which made a similar change. Lord Glenlee presented to the Edinburgh college museum, a pea-hen with the male attire.—ED.

² "Notwithstanding the proximity of the pheasant to the nature of the barn-door fowl," says Mr. C. Waterton, "still it has that within it which baffles every attempt on our part to render its domestication complete. What I allude to is, a most singular innate timidity, which never fails to show itself on the sudden and abrupt appearance of an object. I spent some months in trying to overcome this timorous propensity in the pheasant, but I failed completely in the attempt. The young birds, which had been hatched under a domestic hen, soon became very tame, and would even receive food from the hand, when it was offered cautiously to them. They would fly up to the window, and would feed in company with the common poultry. But, if any body approached them unawares, off they went to the nearest cover, with surprising velocity. They remained in it till all was quiet, and then returned with their usual confidence. Two of them lost their lives in the water, by the unexpected appearance of a pointer, while the barn-door fowls seemed scarcely to notice the presence of the intruder. The rest took finally to the woods, at the commencement of the breeding season. This particular kind of timid-

This spirit of independence seems to attend the pheasant even in captivity. In the woods, the hen pheasant lays from eighteen to twenty eggs in a season; but in a domestic state she seldom lays above ten. In the same manner when wild she hatches and leads up her brood with patience, vigilance, and courage; but when kept tame, she never sits well; so that a hen is generally her substitute on such occasions; and as for leading her young to their food, she is utterly ignorant of where it is to be found: and the young birds starve if left solely to her protection. The pheasant, therefore, on every account seems better left at large in the woods, than reclaimed to pristine captivity. Its fecundity when wild is sufficient to stock the forest; its beautiful plumage adorns it; and its flesh retains a higher flavour from its unlimited freedom.

However, it has been the aim of late to take these birds once more from the woods, and to keep them in places fitted for their reception. Like all others of the poultry kind, they have no great sagacity, and suffer themselves easily to be taken. At night they roost upon the highest trees of the wood: and by day they come down into the lower brakes and bushes, where their food is chiefly found. They generally make a kind of flapping noise when they are with the females; and this often apprizes the sportsman of their retreats. At other times he tracts them in the snow, and frequently takes them in springs. But of all birds they are shot most easily, as they always make a whirring noise when they rise, by which they alarm the gunner, and being a large mark, and flying very slow, there is scarcely any missing them.

"Ah! what avail his glossy, varying dyes,
His purple crest, and scarlet-circled eyes,
The vivid green his shining plumes unfold,
His painted-wings, and breast that flames with gold."
POPE.

When these birds are taken young into keeping, they become as familiar as chickens; and when they are designed for breeding, they are put together in a yard, five hens to a cock; for this bird, like all of the poultry kind, is very salacious. In her natural state the female makes her nest of dry grass and leaves; the same must be laid for her in the pheasantry, and she herself will sometimes properly dispose them. If she refuses to hatch her eggs, then a common hen must be got to supply her place, which task she will perform with perseverance and success. The

ity, which does not appear in our domestic fowls, seems to me to oppose the only, though, at the same time, an insurmountable, bar to our final triumph over the pheasant. After attentive observation, I can perceive nothing else, in the habits of the bird, to serve as a clew by which we may be enabled to trace the cause of failure in the many attempts which have been made to invite it to breed in our yards, and retire to rest with the barn-door fowl and turkey.
—ED.

young ones are very difficult to be reared; and they must be supplied with ants' eggs, which is the food the old one leads them to gather when wild in the woods. To make these go the farther, they are chopped up with curds, or other meat; and the young ones are to be fed with great exactness, both as to the quantity and the time of their supply. This food is sometimes also to be varied, and woodlice, earwigs, and other insects, are to make a variety. The place where they are reared must be kept extremely clean; their water must be changed twice or thrice a-day; they must not be exposed till the dew is off the ground in the morning; and they should always be taken in before sunset. When they become adult, they very well can shift for themselves, but they are particularly fond of oats and barley.

In order to increase the breed, and make it still more valuable, Longolius teaches us a method that appears very peculiar. The pheasant is a very bold bird, when first brought into the yard among other poultry, not sparing the peacock, nor even such young cocks and hens as it can master; but after a time it will live tamely among them, and will at last be brought to couple with a common hen. The breed thus produced take much stronger after the pheasant than the hen; and in a few successions, if they be left to breed with a cock pheasant, (for the mixture is not barren,) there will be produced a species more tame, stronger, and more prolific; so that he adds, that it is strange why most of our pheasantries are not stocked with birds produced in this manner.

The pheasant, when full-grown, seems to feed indifferently upon every thing that offers. It is said by a French writer, that one of the king's sportsmen, shooting at a parcel of crows, that were gathered round a dead carcass, to his great surprise upon coming up, found that he had killed as many pheasants as crows. It is even asserted by some, that such is the carnivorous disposition of this bird, that when several of them are put together in the same yard, if one of them happens to fall sick, or seems to be pining, that all the rest will fall upon, kill, and devour it. Such is the language of books; those who have frequent opportunities of examining the manners of the bird itself, know what credit ought to be given to such an account.

Of the pheasant, as of all other domestic fowl, there are many varieties. There are white pheasants, crested pheasants, spotted pheasants; but of all others, the golden pheasant of China is the most beautiful.³ It is a doubt whether the peacock itself can bear the comparison. However, the natives of China would not have us consider

³ Owing to the prohibitory laws of China, it was long extremely difficult to obtain living specimens of this bird; and it was, in consequence, a desideratum in European aviaries; it is now, however, common enough in Europe.—ED.

it as their most beautiful bird, though covered all over with eyes, resembling in miniature those of the peacock. By their accounts, it is far exceeded by the fongwang, an imaginary bird, of which they give a most fantastic description. It is thus that the people of every country, though possessed of the greatest advantages, have still others that they would persuade strangers they enjoy, which have existence only in the imagination.

CHAP. VI.

THE PINTADO, OR GUINEA-HEN.

THIS is a very remarkable bird, and in some measure unites the characteristics of the pheasant and the turkey. It has the fine delicate shape of the one, and the bare head of the other. To be more particular, it is about the size of a common hen, but as it is supported on longer legs, it looks much larger. It has a round back, with a tail turned downward like a partridge. The head is covered with a kind of casque; and the whole plumage is black or dark gray, speckled with white spots. It has wattles under the bill, which do not proceed from the lower chap as in cocks, but from the upper, which gives it a very peculiar air; while its restless gait and odd chuckling sound distinguish it sufficiently from all other birds whatever.

It is well-known all over Europe, and even better than with us, as the nations that border on the Mediterranean probably had it before us from those parts of Africa which lay nearest. Accordingly we find it in different countries called by different names, from the place whence they had it. They are by some called the *Barbary-hen*; by others, the *Tamis bird*; and by others, the *bird of Numidia*.¹ We have given it the name of that part of Africa from whence probably it was first brought.

In many parts of their native country they are seen in vast flocks together, feeding their young, and leading them in quest of food. All their habits are like those of the poultry kind, and they agree in every other respect, except that the male and female are so much alike, that they can hardly be distinguished asunder. The only difference lies in the wattles described above; which in the cock are of a bluish cast, in the hen they are more inclining to red. Their eggs, like their bodies, are speckled; in our climate they lay but five or six in a season; but they are far more prolific in their sultry regions at home. They are kept among us rather for show than

¹ The pintado is the bird formerly known to the ancients under the name of Melagris or Numidian fowl. Its flesh was much esteemed by the Romans. Among the varieties of this bird are the crested pintado and the mitred pintado.—ED.

use, as their flesh is not much esteemed, and as they give a good deal of trouble in rearing.

CHAP. VII.

THE BUSTARD.

THE Bustard is the largest land bird that is a native of Britain. It was once much more numerous than it is at present; but the increased cultivation of the country, and the extreme delicacy of its flesh, has greatly thinned the species; so that a time may come when it may be doubted whether ever so large a bird was bred among us.¹ It is probable that long before this the bustard would have been extirpated, but for its peculiar manner of feeding. Had it continued to seek shelter among our woods, in proportion as they were cut down, it must have been destroyed. If in the forest, the fowler might approach it without being seen; and the bird, from its size, would be too great a mark to be easily missed. But it inhabits only the open and extensive plain, where its food lies in abundance, and where every invader may be seen at a distance.

The bustard is much larger than the turkey, the male generally weighing from twenty-five to twenty-seven pounds. The neck is a foot long, and the legs a foot and a half. The wings are not proportionable to the rest of the body, being but four feet from the tip of the one to the other; for which reason the bird flies with great difficulty. The head and neck of the male are ashy-coloured; the back is barred transversely with black, bright, and rust colour. The greater quill-feathers are black; the belly white; and the tail, which consists of twenty feathers, is marked with broad black bars.

It would seem odd, as was hinted before, how so large a land bird as this could find shelter in so cultivated a country as England; but the wonder will cease when we find it only in the most open countries, where there is scarce any approaching it without being discovered. They are frequently seen in flocks of fifty or more, in the extensive downs of Salisbury Plain, in the heaths of Sussex and Cambridgeshire, the Dorsetshire uplands, and so on as far as East Lothian in Scotland. In those extensive plains, where there are no woods to screen the sportsman, nor hedges to creep along, the bustards enjoy an indolent security. Their food is composed of the berries that grow among the heath, and the large earth-worms that appear in great quantities on

¹ Some twenty-five years since, a few packs might occasionally be met with on that extensive tract of down, known by the name of Salisbury-plain, in the vicinity of Stonehenge, and within that period of time a straggler has been sometimes accidentally seen in the above locality.—ED.

the downs before sun-rising in summer. It is in vain that the fowler creeps forward to approach them; they have always sentinels placed at proper eminences, which are ever on the watch, and warn the flock of the smallest appearance of danger. All therefore that is left the sportsman, is the comfortless view of their distant security. He may wish; but they are in safety.

It sometimes happens that these birds, though they are seldom shot by the gun are often run down by the greyhounds. As they are voracious and greedy, they often sacrifice their safety to their appetite, and feed themselves so very fat, that they are unable to fly without great preparation. When the greyhound, therefore, comes within a certain distance, the bustard runs off flapping its wings, and endeavouring to gather air enough under them to rise; in the meantime the enemy approaches nearer and nearer, till it is too late for the bird even to think of obtaining safety by flight; for just at the rise there is always time lost, and of this the bird is sensible; it continues, therefore, on the foot, until it has got a sufficient way before the dog for flight, or until it is taken.

As there are few places where they can at once find proper food and security, so they generally continue near their old haunts, seldom wandering above twenty or thirty miles from home. As their food is replete with moisture, it enables them to live upon these dry plains, where there are scarcely any springs of water, a long time without drinking. Besides this, Nature has given the males an admirable magazine for their security against thirst. This is a pouch, the entrance of which lies immediately under the tongue, and capable of holding near seven quarts of water.² This is probably filled upon proper occasions, to supply the hen when sitting, or the young before they can fly.

Like all other birds of the poultry kind, they change their mates at the season of incubation, which is about the latter end of summer. They separate in pairs, if there be a sufficiency of females for the males: but when this happens to be otherwise, the males fight until one of them falls. In France they often find some of those victims to gallantry dead in the fields, and no doubt are not displeased at the occasion.

² The size of this reservoir seems something exaggerated: for with an addition of nearly fourteen pounds weight thrown forwards, the centre of gravity must be so overbalanced as to destroy its power of flight, and impede its running. About half this quantity seems a probable sufficiency for all its wants. This singular reservoir was first discovered by Dr. Douglas, who supposes that the bird fills it with water, to supply its thirst in the middle of those extensive plains where it is accustomed to wander. It likewise makes a further use of it in defending itself against the attacks of birds of prey: on these occasions, it throws out the water with such violence, as not unfrequently to baffle the pursuit of the enemy.—Ed.

They make their nests upon the ground, only just scraping a hole in the earth, and sometimes lining it with a little long grass or straw. There they lay two eggs only, almost of the size of a goose egg, of a pale olive brown, marked with spots of a darker colour. They hatch in about five weeks, and the young ones run about as soon as they are out of the shell.³

The bustards assemble in flocks in the month of October, and keep together till April. In winter, as their food becomes more scarce, they support themselves indiscriminately, by feeding on moles, mice, and even little birds, when they can seize them. For want of other food, they are contented to live upon turnip-leaves, and such like succulent vegetables. In some parts of Switzerland, they are found frozen in the fields in severe weather; but when taken to a warm place they again recover. They usually live fifteen years, and are incapable of being propagated in a domestic state, as they probably want that food which best agrees with their appetite.

³ The female is not much more than half the size of the male. The top of her head is of a deep orange, and the rest of the head brown. Her colours are not so bright as those of the male, and she wants the tuft on each side of the head. She also wants the reservoir.—Ed.

SUPPLEMENTARY NOTE.

There are eleven species of this bird; viz. the Arabian Passurage, Ruffed, Indian, White-eared, White-chinned, Thick-kneed, Chilese, Great and Little Bustard. The two latter are natives of our island.

The Little Bustard is in length only seventeen inches. The bill is pale brown; irides red; the top of the head is black, spotted with pale rust-colour; the sides of the head, the chin, and throat, are of a reddish white, marked with a few dark spots; the whole neck is black, encircled with an irregular band of white near the top and bottom; the back and wings are rust-colour, mottled with brown, and crossed with fine irregular black lines; the under parts of the body, and outer edges of the wings, are white. The tail consists of eighteen feathers; the middle ones are tawny, barred with black; the others are white, marked with a few irregular bands of black: the legs are gray. The female is smaller, and has not the black collar on the neck; in other respects she nearly resembles the male. This bird is very uncommon in this country. It is very common in France, where it is taken in nets, like the partridge, or hunted. The bustards arrive in the beginning of December, and remain only until the month of March, when they have to proceed further north; assembling in small groups, and sometimes in large companies, amounting even to thirty or forty; they betake themselves to the vast plains of Champagne, Poitou, &c.; but during severe winters, and when snow is abundant, they are generally distributed over the country, and keep more to the south. They prefer those spots which are remote from any habitation, and sufficiently elevated to enable them to discover the approach of danger when at some distance. They are usually hunted with dogs and horses, and the best time is supposed to be during a frost. Before they are able to fly, they are obliged to run a considerable distance with the wings extended. As there is considerable difficulty in getting near them,

several stratagems have been resorted to, to obtain that end, such as approaching them disguised in the skin of a cow, or under a moving covering of wood resembling a shepherd's hut. It is a very shy and cunning bird; if disturbed, it flies two or three hundred paces, not far from the ground, and then runs away much faster than one can follow on foot. The female lays her eggs in June, to the number of three or four, of a glossy green colour: as soon as the young are hatched, she leads them about, as the hen does her chickens. They begin to fly about the middle of August. Attempts have been made to domesticate the bustard, but hitherto unsuccessfully. Montague says that they never could be kept alive in confinement above two or three years; and Pallas says that the domesticated bustards in the Crimea have never been known to lay eggs.

The florakin is ranked first upon the game list in India, although it is exceedingly scarce. It is of the bustard genus, and is to be found in open champaign districts, affecting the same haunts and habits as does its congener in this country. The flavour of the florakin approximates to that of the turkey, and the flesh is remarkably white. In plumage it somewhat resembles that of the bittern. Owing to its extreme scarcity there is not perhaps one European out of a thousand who has resided for years in the East Indies, that has ever had an opportunity of witnessing this *rara avis*. There is a minor species of florakin, known by the name of 'the leek,' which is occasionally to be found in the rice-grounds. This is not so scarce a bird as the former, but it is a delicious eating prize when obtained. Many young tiro Indian sportsmen run away with an erroneous idea that the leek is the florakin, but such is not the case. There is an old current saying among "Shirkarrees" in India, that "he who can sport a florakin upon his table, may safely ask an emperor to dine with him."

CHAP. VIII.

THE GROUSE, AND ITS AFFINITIES.

THE cock-of-the-wood, the black cock, the grouse,¹ and the ptarmigan—these are all birds of a similar nature, and chiefly found in heathy moun-

¹ By the word *grouse* we, in general language, are most apt to associate our ideas with the common muir-fowl; but in the technical terms of ornithology the generic name of *grouse* and *tetrao* is restricted to those bearing the form of the European wood-grouse, dusky grouse of America, &c. They are the largest birds of the family, of a very round and powerful form, and frequent heathy forests in preference to the wild and open muir, perch and often roost on trees, where young shoots and tender bark also supply them with food; and although the legs are plumed with soft feathers, the toes are naked. The tail is composed of broad feathers, and is proportionably long and rounded. They are mostly polygamous, and the females and young differ considerably from the males; the plumage of the former being shades of brown and tawny, with black bars and markings; the colour of the latter distributed in broad masses of black, glossy green, or steel blue, and deep brown. They inhabit North America and Europe; those of the latter extending into northern Asia. Grouse are found in great numbers on the mountains of Northumberland and Cumberland, some few in the New Forest of Hampshire, and some in Wales. In the vicinity of the Grampian mountains and the Highlands of Scotland they are so plentiful

that a tolerable shot may kill from 20 to 30 brace a day for the first three weeks of the season, provided the weather is favourable; an excursion, therefore, to that country in the grouse season, affords the keen sportsman a noble entertainment. In many places it is well-known that several have killed 50 brace of birds with a single-barrelled gun between sunrise and sunset.—*The Sportsman*.

tains and piny forests, at a distance from mankind. They might once indeed have been common enough all over England, when a great part of the country was covered with heath; but at present their numbers are thinned; the two first of this kind are utterly unknown in the south, and have taken refuge in the northern parts of Scotland, where the extensive heaths afford them security, and the forests shelter.

The cock-of-the-wood is sometimes of the size of a turkey, and often weighs near fourteen pounds; the black cock, of which the male is all over black, though the female is of the colour of a partridge, is about the size of a hen, and, like the former, is only found with us in the Highlands of Scotland; the grouse is about half as large again as a partridge, and its colour much like that of a woodcock, but redder; the ptarmigan is still somewhat less, and is of a pale brown or ash colour. They are all distinguishable from other birds of the poultry kind by a naked skin of a scarlet colour above the eyes, in the place and of the figure of eyebrows.

It seems to be something extraordinary, that all the larger wild animals of every species choose the darkest and the inmost recesses of the woods for their residence, while the smaller kinds come more into the open and cultivated parts, where there is more food and more danger. It is thus with the birds I am describing: while the cock-of-the-wood is seldom seen, except on the inaccessible parts of heathy mountains, or in the midst of piny forests, the grouse is found in great numbers in the neighbourhood of corn-fields, where there is heath to afford retreat and shelter.—Their food too somewhat differs; while the smaller kind lives upon heath blossoms, cranberries, and corn, the larger feeds upon the cones of the pine-tree, and will sometimes entirely strip one tree before it offers to touch those of another, though just beside him. In other respects the manners of these birds are the same; being both equally simple in their diet, and licentious in their amours.

The cock-of-the-wood, for it is from him we will take our description, is, as was said, chiefly fond of a mountainous and woody situation. In winter he resides in the darkest and inmost part of the woods; in summer he ventures down from his retreats, to make short depredations on the farmer's corn. The delicacy of his flesh in some measure sets a high value upon his head; and as he is greatly sought after, so he continues, when he comes down from the hills, always on his guard. Upon these occasions he is seldom

surprised; and those who would take him must venture up to find him in his native retreats.²

The cock-of-the-wood, when in the forests, attaches himself principally to the oak and the pine-tree; the cones of the latter serving for his food, and the thick boughs for a habitation. He even makes a choice of what cones he shall feed upon; for he sometimes will strip one tree bare before he will deign to touch the cones of another. He feeds also upon ants' eggs, which seem a high delicacy to all birds of the poultry kind: cranberries are likewise often found in his crop; and his gizzard, like that of domestic fowls, contains a quantity of gravel, for the purpose of assisting his powers of digestion.

At the earliest return of spring, this bird begins to feel the genial influence of the season. During the month of March the approaches of courtship are continued, and do not desist till the trees have all their leaves and the forest is in full bloom. During this whole season, the cock-of-the-wood is seen at sunrise and setting, extremely active, upon one of the largest branches of the pine-tree. With his tail raised and expanded like a fan, and the wings drooping, he is seen walking backward and forward, his neck stretched out, his head swollen and red, and making a thousand ridiculous postures: his cry upon that occasion is a kind of loud explosion, which is instantly followed by a noise like the whetting of a scythe, which ceases and commences alternately for about an hour, and is then terminated by the same explosion.

During the time this singular cry continues, the bird seems entirely deaf and insensible of every danger; whatever noise may be made near him, or even though fired at, he still continues his call; and this is the time that sportsmen generally take to shoot him. Upon all other occasions, he is the most timorous and watchful bird in nature; but now he seems entirely absorbed by his instincts; and seldom leaves the

place where he first begins to feel the accessions of desire. This extraordinary cry, which is accompanied by a clapping of the wings, is no sooner finished, than the female, hearing it, replies, approaches, and places herself under the tree, from whence the cock descends to impregnate her. The number of females that, on this occasion, resort to his call is uncertain: but one male generally suffices for all.

The female is much less than her mate, and entirely unlike him in plumage, so that she might be mistaken for a bird of another species: she seldom lays more than six or seven eggs, which are white, and marked with yellow, of the size of a common hen's egg; she generally lays them in a dry place, and a mossy ground, and hatches them without the company of the cock. When she is obliged, during the time of incubation, to leave her eggs in quest of food, she covers them up so artfully, with moss or dry leaves, that it is extremely difficult to discover them. On this occasion she is extremely tame and tranquil, however wild and timorous in ordinary. She often keeps to her nest, though strangers attempt to drag her away.

As soon as the young ones are hatched, they are seen running with extreme agility after the mother, though sometimes they are not entirely disengaged from the shell. The hen leads them forward, for the first time, into the woods, shows them ants' eggs, and the wild mountain-berries, which, while young, are their only food. As they grow older, their appetites grow stronger, and they then feed upon the tops of heather, and the cones of the pine-tree. In this manner they soon come to perfection: they are a hardy bird, their food lies everywhere before them, and it would seem that they should increase in great abundance. But this is not the case; their numbers are thinned by rapacious birds and beasts of every kind; and still more by their own salacious contests.

As soon as the clutching is over, which the female performs in the manner of a hen, the whole brood follows the mother for about a month or two; at the end of which the young males entirely forsake her, and keep in great harmony together till the beginning of spring. At this season they begin for the first time to feel the genial access; and then adieu to all their former friendships! They begin to consider each other as rivals; and the rage of concupiscence quite extinguishes the spirit of society. They fight each other like game-cocks; and at that time are so inattentive to their own safety, that it often happens that two or three of them are killed at a shot. It is probable that in these contests, the bird which comes off victorious takes possession of the female seraglio, as it is certain they have no faithful attachments.³

³ This account of the cock-of-the-wood is taken from the *Journal Economique*, and may be relied on.

² The cock-of-the-wood was formerly common in the pine-forests of Scotland and Ireland, as well as all over England when a great part of the country was covered with heath, it is now wholly unknown in the south, and but for the protection afforded the species by the Marquis of Breadalbane in Scotland, would probably be now almost extinct there. It abounds, however, in the forests of Russia, Norway, Sweden, and other parts of the north as well as among the dense pine-woods of the Alps. It varies in weight from 8 to 14 pounds. The female of the species is much less, and entirely unlike the male in plumage. The general colour of the male on the upper parts is chestnut brown irregularly marked with blackish lines; the breast is glossy greenish black, passing into black on the under surface. In the female the head, neck, and back are marked with transverse bars of red and black; the under surface is pale orange yellow barred with black. The black cock appears to have made its way into the Lake district, four of these fine birds having been shot in the autumn of 1845, on the hills between Windermere and Eastwaite. They are supposed to have been bred on the plantations of H. Curwen, Esq.—Ed.

SUPPLEMENTARY NOTE.

The genus *Tetrao* of authors, comprehending birds of the gallinaceous order, characterized by a full habit of body, short, concave, rounded wings, legs of moderate size, and having the tarsus completely or partially covered with feathers, a small head, and bare superciliary crests, has by some been divided into two genera, one including the grouse properly so called, which have the toes pectinated with elongated lateral scales, the other including the ptarmigans, of which the toes are destitute of these lateral scales and covered with feathers. There are three species of this genus resident in Britain, of which one belongs to the first or grouse section, the rest to the second, or that including the ptarmigans. They are popularly named the black grouse, the red grouse, and the ptarmigan.

1. The black grouse (*Tetrao Tetrix*) is nearly the size of the domestic fowl. The male differs greatly from the female in colour, and in the form of its tail, which is lyrate, or has the outer feathers longer and curved outwards. The general colour of the plumage is black, that of the neck and back glossed with deep blue; the lower wing-coverts, lower tail-coverts, and bases of the secondary quills, white. The female has the tail slightly forked, its lateral feathers straight; the general colour is yellowish-red, spotted and undulated with brownish-black. In its internal organization this species exhibits the peculiar character distinctive of the gallinaceous birds in a remarkable degree of development. The œsophagus is dilated into a very large membranous crop, which covers the fore-part of the neck; it then contracts, and enlarges into a proventriculus of moderate size. The stomach is a very muscular gizzard, lined with a thick and dense rugous membrane. The intestine is of considerable length, and has two extremely elongated cœcal appendages, furnished internally with longitudinal ridges, and in which the residuum of the food receives a second elaboration. It feeds on fresh twigs of *Erica cinerea*, *Calluna vulgaris*, *Vaccinium myrtillus*, willows, and other shrubs, as well as on berries and leaves of various plants, gradually filling its crop, which is capable of containing a globular mass from three and a half to four inches in diameter. The food varies according to the season, although heath twigs always form the principal part. In spring the tops of eriophora, carices, blades of grass, willow-cattkins, and buds of trees; in summer, leaves of various shrubs; and in winter, juicy twigs of all kinds, are found in the crop.

The black grouse, then, is a phytophagous bird, which, feeding on substances containing comparatively little nourishment, introduces a large quantity at a time, like a ruminating quadruped, and gradually triturates it in the gizzard, with the aid of particles of white quartz, which it picks up as required. In the gizzard the mass, acted upon by the fluid abundantly secreted by the proventricular glands, is reduced to a pulpy mass, which in the duodenum is further diluted by the pancreatic juice, and mixed with the bile. The nutritious parts are absorbed as it passes along, and the cœcal appendages subject it to a further elaboration. In searching for food it frequents the lower grounds of the less cultivated districts, keeping for the most part in the vicinity of woods or thickets, to which it retreats for shelter or protection. Sometimes it makes an excursion into the stubble fields, or even attacks the standing corn. It walks and runs among the herbage with considerable agility, perches adroitly on trees, and may often, especially in spring, be seen on the turf tops of the low walls enclosing plantations. Its flight is heavy, direct, and of moderate velocity, but is capable of being protracted to a great distance. This species,

however, does not generally wander far from its ordinary haunts, which are the lower slopes of hills covered with coppice, interspersed with heath, rank grass, and ferns, or valleys flanked by rocky and wooded ranges. In such situations, it is plentiful in many parts of the northern and middle divisions of Scotland, in several districts in the southern division, and in the north of England; but is rare in other portions of that country. In autumn it falls an easy prey to the sportsman, but in winter and the early part of spring it is shy and difficult to be procured. As an article of food it ranks high, the flesh being whiter than that of the red grouse, and the males weighing from three to four pounds. Its natural enemies are foxes, polecats, eagles, and falcons. Vipers are said to destroy its eggs and young, as do ravens, hooded crows, and carrion crows.

The males keep by themselves in autumn and winter, and towards the middle of spring join the females, fighting with each other when they meet. At this season, the red space over the eye assumes a deeper tint, and the bird manifests increased activity and vigour; but when the excitement is over, the males appear fatigued and emaciated, meet together without manifesting animosity, and seem intent on recruiting their diminished energies. The female forms a rather inartificial nest of dry grass, in which she deposits from five to ten eggs, of a regular oval shape, generally two inches long, with a yellowish ground colour, irregularly spotted and dotted with brownish-red. As the nests are usually placed in low situations, they are frequently partially or entirely inundated in very wet seasons. The young, which are at first covered with close, fine down, are able to run about the moment after they leave the egg.

Hybrids are sometimes, though very rarely, produced between this species and the red grouse, as well as the pheasant. Formerly another species of this genus, the wood-grouse, or capercaillie (*Tetrao Urogallus*), occurred in the northern parts of Scotland, but has been nearly extirpated. The last individual recorded to have been seen was killed in 1769, in Strathglass, to the north of Inverness. This species—which is about equal in size to a turkey—is still abundant in Sweden and Norway, whence it is imported in winter, when it may frequently be obtained in the London markets.

The ptarmigans are distinguished from the grouse by having the tarsi and toes feathered, and by the want of the lateral pectiniform scales appended to the toes of the latter. In most other respects, however, the genera *Tetrao* and *Lagopus* are so similar, that it may well be doubted whether they really ought to be considered as distinct. It has been stated, that only one species of grouse occurs in Britain, while there are two species of ptarmigan,—the red grouse of authors, or, more properly, the brown ptarmigan,—and the common or gray ptarmigan.

The red-grouse (*Lagopus Scoticus*) is peculiar to Great Britain and Ireland, not having hitherto been observed in any other part of the world. It is a strong full-bodied bird, the male about sixteen inches in length, its extended wings measuring twenty-seven on an average. The colour varies a little with the seasons. In winter the adult male is chestnut-brown, inclining to red on the neck; on the body variegated with black; on the breast blackish, with many of the feathers tipped with white. The general colour of the female is yellowish-red, spotted and varied with black. In summer the male is chestnut brown, minutely varied and spotted with black; the head and neck also varied; the breast darker and more obscurely varied. The female is yellowish-red, spotted and varied with black; most of the feathers on the upper parts tipped with yellowish-white. The superciliary membranes or crests, which are larger in

the male, are vermilion, the bill brownish-black, the iris hazel, the claws blackish-brown, grayish-yellow at the end. Although this bird occurs in Ireland and England, it is more abundant in Scotland, where it is met with on the heaths, from the level of the sea to the height of about two thousand feet. The low sandy heaths of the eastern parts of the middle division appear to be less favourable to it than the more moist peaty tracts of the western and northern districts, where the shrubs on which it feeds attain a greater size. In the central regions of the Grampians it is equally abundant as on the moors of the Hebrides; and on the hilly ranges of the south, the Pentlands, the Lammermuir, and the mountains of Peebles, Dumfries, and Selkirk, it is still plentiful.

It is pleasant to hear the bold challenge of the cock at early dawn on the wild moor, remote from human habitation. You may fancy it to resemble the syllables *go, go, go, go back, go back*, although the Highlanders, naturally imagining the bird to speak Gaelic, interpret it as signifying *co, co, co, mo-chlaidh, mo-chlaidh*, that is, "Who! who! (goes there,) my sword! my sword!"

The food of this species consists chiefly of the tops of heath, *Calluna vulgaris*, *Erica cinerea*, and the leaves and twigs of other shrubs and herbaceous plants. On ordinary occasions the species does not fly much, but keeps concealed among the heath, seldom choosing to rise unless its enemy comes very near. On the approach of danger it lies close to the ground, when, being of a colour not contrasting strongly with that of the plants around, it is with difficulty perceived by rapacious birds, among which its principal enemies are the golden eagle, the peregrine falcon, the common buzzard, and the henharrier. The quadrupeds which occasionally prey upon it are the polecat, the pine martin, the fox, and perhaps the ermine. When traced by a dog, it either runs to some distance or squats at once. On such occasions the male is generally the first to rise. He erects himself among the heath, stretches out his neck, utters a loud cackle, and flies off, followed by the female and young, affording by their straightforward, heavy, though strong, flight, an easy mark to a good shot. Young birds often allow a person to come within a few yards or even feet before they fly off, and even the old males, unless previously harassed, rise within shooting distance.

In a district where there is choice of situation, the red grouse prefer the slopes of hills not exceeding two thousand feet high; but they are to be found on the lowest and most level peat-bogs, especially if there are large tufts of heath surrounded by banks. Those which in summer and autumn reside on the heights usually descend in winter; but even during that season individuals may be found in their highest range, which is bounded less by actual elevation than by the disappearance or scantiness of heath. This species generally flies low and heavily, moving its wings rapidly, with a whirring noise, and proceeding in a direct course without undulations. Occasionally, when at full speed, and especially when descending parallel to a declivity, it sails at intervals, that is, proceeds for a short time with expanded and apparently motionless wings. Its flight is strong, often protracted to a considerable distance, and capable of being urged to a surprising degree of velocity, when the birds have been pursued by a hawk. Although the haunts of the red grouse are the heathery moors, it has sometimes been found in stubble-fields, or among corn, bordering on uncultivated tracts; and when it finds an opportunity of feeding on oats, it does not scruple to avail itself of it. Unlike the black grouse, it is seldom or never met with in woods.

The male is not polygamous, nor does he at any time desert his mate. When incubation is over, and

the young run about, they are tended by both parents, the female manifesting great anxiety for their safety, and feigning lameness to induce a person who has approached them to follow her. When surprised on the nest, she flies with a low undecided flight to a short distance, and runs off among the heath. The young are soon able to fly, and the flock keeps together until the end of autumn, unless scattered and thinned by sportsmen and vagabonds. Towards the beginning of winter several flocks often unite and keep together, forming what are called packs. They are then generally more shy, and continue so until the beginning of spring, when they separate and pair, without manifesting any remarkable animosity; for although the cocks may occasionally fight, they have not those regular periodical battles described by authors as enacted by many species of the grouse genus. The nest is found in the midst of the heath, in a shallow cavity, and formed of bits of twigs, grass, and sometimes a few feathers. The eggs are from eight to twelve, or even more, generally an inch and seven-twelfths in length, an inch and three-twelfths across, of a regular oval form, yellowish-white, pale yellowish-gray, or brownish-yellow, thickly clouded, blotched, and dotted with blackish and amber brown.

The young leave the nest soon after they are freed from the shell. They are at first covered with a fine close down of a pale yellowish-gray tint, mottled beneath with pale brown, patched above with deep brown, the top of the head chestnut, margined with darker.

As an article of food, the red grouse is highly esteemed. The flesh is very dark-coloured, and has a peculiar somewhat bitter taste, which by some is considered as extremely pleasant. The species is capable of living in a state of domestication, and then feeds on grain, bread, potatoes, and other substances, although it always prefers its natural food. A few instances have been known of its breeding in captivity; but, from its habits, it does not seem probable that it could be trained in subjection, like the domestic fowl.

The Gray Ptarmigan (*Lagopus cinereus*) is the only other species of this genus that occurs in Britain, where it is now confined to the summits of the higher mountains of the middle and northern divisions of Scotland. It resembles the red grouse in form and proportions, the male measuring about fifteen inches in length, and about twenty-five inches between the points of its extended wings. In winter the male is white, with a black band from the bill to the eye, the tail-feathers grayish-black, barred and tipped with white, the shafts of the primaries brown. The female in winter is also white, the feathers between the bill and the eye black at the base only, the tail-feathers brownish-black, based and tipped with white. In spring both sexes are white, mottled with dark gray, and yellow feathers, which are barred with black; the wings, lower parts, and tail, as in winter. In summer the head, neck, upper parts and sides, are spotted and barred with yellow and brownish-black; the wings, lower parts, and tail, as in winter. In autumn the plumage of the upper parts and sides is finely barred with grayish-white and grayish-black; the head, neck, and sides, retaining the yellow summer feathers longest; the wings, lower parts, and tail, as in winter. The young are spotted and barred with yellow and dark brown; the wings white, the shafts of the primaries dusky; the tail brownish black, the middle feathers barred with yellow and dark gray.

This beautiful bird is met with in flocks on the bare and weather-beaten summits of the Grampians, and other high mountains of the North, where they reside from the beginning of spring to the close of autumn, seldom descending into the heathy tracts, unless in winter when the ground is covered with snow. Its food consists of various plants, chiefly of

a shrubby nature; twigs and leaves of *Calluna vulgaris*, *Erica cinerea*, *Empetrum nigrum*, *Vaccinium myrtillus*, *V. vitis-idaea*, *Salix herbacea*, and others, being in fact similar to that of the red grouse. Its habits are also similar, but it generally allows a much nearer approach, and seems in no degree aware of danger from the proximity of man, remaining squatted on the ground, or on a stone, until you almost trample upon it. When in packs, however, it is more shy, although even then it seldom flies off until one comes within shooting distance.

While feeding, the ptarmigans run and walk among the lichen-crusts and crumbling fragments of rock, from which it is very difficult to distinguish them when they remain motionless, as they invariably do should a person be in sight. Indeed, unless you are directed to a particular spot by their strange low croaking cry, which is not very unlike that of a frog, you may pass through a flock without observing a single individual. When squatted, however, they utter no sound, their object being to conceal themselves; and if you discover the one from which the cry has proceeded, you generally find him on the top of a stone, ready to spring off the moment you show an indication of hostility. If you throw a stone at him, he rises, utters his call, and is immediately joined by all the individuals around, which, to your surprise, you see spring up one by one from the bare ground. They generally fly off in a loose body, with a direct and moderately rapid flight, resembling, but lighter than that of the red grouse, and settle on a distant part of the mountain, or betake themselves to one of the neighbouring summits, perhaps more than a mile distant. Early in spring they separate and pair. The nest is a slight hollow, scantily strewn with a few twigs and stalks, or blades of grass. The eggs are of a regular oval form, about an inch and seven-twelfths in length, an inch and from one to two-twelfths across, of a white, yellowish-white, or reddish colour, blotched and spotted with dark brown, the markings larger than those of the red grouse. The young run about immediately after leaving the shell, and from the commencement are so nimble and expert at concealing themselves, that a person who has accidentally fallen in with a flock very seldom succeeds in capturing one. They are at first covered with a light yellowish-gray down, patched on the back with brown, and having on the top of the head a light chestnut mark, edged with darker. When fledged, they are very similar to the young of the red grouse, but banded and spotted with brighter reddish-yellow.

The flesh of the gray ptarmigan is not so dark as that of the red grouse, nor quite so bitter, although it has the same flavour. A very considerable quantity is annually killed, the bird being held in estimation not only as an article of food, but, when stuffed, as a domestic ornament.

The following are some varieties of grouse.

The Ruffed Grouse.—The size of this bird is between that of a pheasant and partridge. The bill is brownish. The head is crested; and, as well as all the upper parts, is variegated with different tints of brown mixed with black. The feathers on the neck are long and loose; and may be erected at pleasure, like those of the cock. The throat and the forepart of the neck are orange brown; and the rest of the under-parts yellowish white, having a few curved marks on the breast and sides. The tail consists of eighteen feathers, all of which are crossed with narrow bars of black, and one broad band of the same near the end. The legs are covered to the toes (which are flesh-coloured and pectinated at the sides) with whitish hairs. The ruffed grouse has hitherto been found only on the new continent. He is a fine bird when his gaiety is displayed; that is, when he spreads his tail like that of a turkey-cock, and erects the circle

of feathers round his neck like a ruff, walking with a very stately and even pace, and making a noise somewhat like a turkey. This is the moment that the sportsman seizes to fire at him; for, if the bird sees that he is discovered, he immediately flies off to the distance of several hundred yards before he again settles. There is something very remarkable in what is called the *thumping* of these birds. This they do, as the sportsmen tell us, by clapping their wings against their sides. They stand upon an old fallen tree, and in this station they begin their strokes gradually, at about two seconds of time from one another, and repeat them quicker and quicker, until they make a noise not unlike distant thunder. This continues from the beginning about a minute; the bird ceases about six or eight minutes, and then begins again. The sound is often heard at a distance of nearly half a mile; and sportsmen take advantage of this note, to discover the birds, and shoot them. The grouse commonly practise their thumping during the spring and fall of the year; about nine or ten o'clock in the morning, and four or five in the afternoon.

The Pinnated Grouse.—"It is somewhat extraordinary," says Wilson in his 'American Ornithology,' "that the European naturalists, in their various accounts of our different species of grouse, should have said little or nothing of the one now before us, which, in its voice, manners, and peculiarity of plumage, is the most singular, and, in its flesh, the most excellent, of all those of its tribe that inhabit the territory of the United States. Buffon has confounded it with the ruffed grouse, the common partridge of New England, or pheasant of Pennsylvania (*tetrao umbellus*); Edwards and Pennant have, however, discovered that it is a different species; but have said little of its note, of its flesh, or peculiarities; for, alas! there was neither voice, nor action, nor delicacy of flavour in the shrunk and decayed skin from which the former took his figure, and the latter his description; and to this circumstance must be attributed the barrenness and defects of both. This rare bird, though an inhabitant of different and very distant districts of North America, is extremely particular in selecting his place of residence; pitching only upon those tracts whose features and productions correspond with his modes of life, and avoiding immense intermediate regions that he never visits. Open dry plains, thinly interspersed with trees, or partially overgrown with shrub oak, are his favourite haunts. Their predilection for such situations will be best accounted for by considering the following facts and circumstances:—First, their mode of flight is generally direct, and laborious, and ill-calculated for the labyrinth of a high and thick forest, crowded and intersected with trunks and arms of trees, that require continual angular evolution of wing, or sudden turnings, to which they are, by no means, accustomed. I have always observed them to avoid the high timbered groves that occur here and there in the barrens. Connected with this fact is a circumstance related to me by a very respectable inhabitant of that country, viz. that one forenoon a cock grouse struck the stone chimney of his house with such force, as instantly to fall dead to the ground.

"Secondly, their known dislike of ponds, marshes, or watery places, which they avoid on all occasions, drinking but seldom, and, it is believed, never from such places. Even in confinement this peculiarity has been taken notice of. While I was in the State of Tennessee, a person living within a few miles of Nashville had caught an old hen grouse in a trap; and, being obliged to keep her in a large cage, as she struck and abused the rest of the poultry, he remarked that she never drank, and that she even avoided that quarter of the cage where the cup containing the water was placed. Happening, one day,

to let some water fall on the cage, it trickled down in drops along the bars, which the bird no sooner observed, than she eagerly picked them off, drop by drop, with a dexterity that showed she had been habituated to this mode of quenching her thirst; and probably, to this mode only, in those dry and barren tracts, where, except the drops of dew and drops of rain, water is very rarely to be met with. For the space of a week he watched her closely, to discover whether she still refused to drink; but, though she was constantly fed with Indian corn, the cup and water still remained untouched and untasted. Yet no sooner did he again sprinkle water on the bars of the cage, than she eagerly and rapidly picked them off as before. The last, and probably the strongest, inducement to their preferring these plains, is the small acorn of the shrub oak; the strawberries, huckleberries, and partridgeberries, with which they abound, and which constitute the principal part of the food of these birds. These brushy thickets also afford them excellent shelter, being almost impenetrable to dogs or birds of prey. But what appears to me the most remarkable circumstance relative to this bird, is, that not one of all those writers who have attempted its history, have taken the least notice of two extraordinary bags of yellow skin which mark the neck of the male, and which constitute so striking a peculiarity. These appear to be formed by an expansion of the gullet, as well as of the exterior skin of the neck, which, when the bird is at rest, hangs in loose, pendulous, wrinkled folds, along the side of the neck, the supplemental wings, at the same time, as well as when the bird is flying, lying along the neck. But when these bags are inflated with air, in breeding time, they are equal in size, and very much resemble in colour a middle-sized fully ripe orange. By means of this curious apparatus, which is very observable several hundred yards off, he is enabled to produce the extraordinary sound mentioned above, which, though it may easily be imitated, is yet difficult to describe by words. It consists of three notes, of the same tone, resembling those produced by the night hawks in their rapid descent; each strongly accented, the last being twice as long as the others. When several are thus engaged, the ear is unable to distinguish the regularity of these triple notes, there being, at such times, one continued humming, which is disagreeable and perplexing, from the impossibility of ascertaining from what distance, or even quarter, it proceeds. While uttering this, the bird exhibits all the ostentatious gesticulations of a turkey cock; erecting and fluttering his neck wings, wheeling and passing before the female, and close before his fellows, as in defiance. Now and then are heard some rapid and crackling notes, not unlike that of a person tickled to excessive laughter; and, in short, one can scarcely listen to them without feeling disposed to laugh from sympathy. These are uttered by the males while engaged in fight, on which occasion they leap up against each other, exactly in the manner of turkeys, seemingly with more malice than effect. This humming continues from a little before day-break to eight or nine o'clock in the morning, when the parties separate to seek for food. The pinnated grouse is nineteen inches long, twenty-seven inches in extent, and, when in good order, weighs about three pounds and a half."

The Rock Grouse.—Orange, with black bands and white blotches; the toes are downy; the tail-feathers black, tipped with white; the middle ones are entirely white. The rock grouse inhabits Hudson's Bay; is less than the last; it does not frequent woods, but sits on the tops of rocks, and makes a cry like a man calling with a loud voice.

The Sand Grouse.—Its collar, belly, and vent are black; the tail-feathers are barred with brown and gray, and tipped with white; the two middle ones are

tawnyish; the head is ashy; the chin, pale yellow, with a black semicircle on the throat, the feathers truncate and shining; the tail is barred, the two middle feathers subulate at the tip; the legs behind are naked, having a small spur. The female of this species is yellowish, having the head and neck spotted with black, and the back is barred with black.

The Heteroclitous Grouse.—The feet are three-toed; the toes are downy, and connected nearly to the tips. The heteroclitous grouse inhabits the southern deserts of Tartary; it is an ambiguous bird, between the bustard and the grouse. The bill is more slender than in others of the tribe; the upper mandible neither arched nor receiving the lower one. Its head and neck are hoary; the chin tawnyish, with an orange spot on each side of the neck; the back is waved with gray and black; the breast is of a pale reddish ash-colour; the belly, flanks, and vent are black; the wings long and pointed, white beneath, and dotted with black above.

Among other varieties of grouse, are the *Hazel Grouse*, pretty generally spread throughout the central countries of Europe—the *Pintado Grouse*, a native of the cold regions of North America—and the *Willow Grouse*, which inhabits the north of Europe and America, as far as the ices of the pole.

CHAP. IX.

OF THE PARTRIDGE, AND ITS VARIETIES.

THE partridge may be particularly considered as belonging to the sportsman. It is a bird which even our laws have taken under protection; and, like a peacock or a hen, may be ranked as a private property. The only difference now is, that we feed one in our farms, the other in our yards: that these are contented captives; those, servants that have it in their power to change their master, by changing their habitation.¹

¹ The length of the partridge is about 13 inches. The bill is light brown; eyes hazel; the general colour of its plumage is brown and ash, elegantly mixed with black; each feather is streaked down the middle with buff colour; the sides of the head are tawny; under each eye there is a small saffron-coloured spot, which has a granulated appearance, and between the eye and the ear a naked skin of a bright scarlet, which is not very conspicuous but in old birds; on the breast there is a crescent of a deep chestnut colour; the tail is short; the legs are of a greenish white, and are furnished with a small knob behind. The female has no crescent on the breast, and her colours in general are not so distinct and bright as those of the male. Partridges pair early in the spring; the female lays from fourteen to eighteen or twenty eggs, making her nest of dry leaves or grass upon the ground. The young birds learn to run as soon as hatched, frequently encumbered with part of the shell sticking to them. It is not uncommon to introduce partridges under the common hen, which hatches and rears them as her own. In this case, the young birds require to be fed with ants' eggs, which are their favourite food, and without which it is almost impossible to bring them up; they likewise eat insects, and when full grown, feed on all kinds of grain and young plants. The affection of the partridge for her young is peculiarly strong and lively; and she is greatly assisted in her care of rearing them by her mate.—Ed.

"These birds," says Willoughby, "hold the principal place in the feasts and entertainments of princes; without which their feasts are esteemed ignoble, vulgar, and of no account. The Frenchmen do so highly value, and are so fond of, the partridge, that if they be wanting, they utterly slight and despise the best-spread tables; as if there could be no feast without them." But however this might be in the times of our historian, the partridge is now too common in France to be considered as a delicacy: and this, as well as every other simple dish, is exploded for luxuries of a more compound invention.

In England, where the partridge is much scarcer, and a great deal dearer, it is still a favourite delicacy at the tables of the rich; and the desire of keeping it to themselves has induced them to make laws for its preservation, no way harmonizing with the general spirit of English legislation. What can be more arbitrary than to talk of preserving the game; which, when defined, means no more than that the poor shall abstain from what the rich have taken a fancy to keep for themselves? If these birds could, like a cock or a hen, be made legal property, could they be taught to keep within certain districts, and only feed on those grounds that belong to the man whose entertainments they improve, it then might, with some show of justice, be admitted, that as a man fed them, so he might claim them. But this is not the case; nor is it in any man's power to lay a restraint upon the liberty of these birds, that, when let loose, put no limits to their excursions. They feed everywhere; upon every man's ground; and no man can say these birds are fed only by me. Those birds which are nourished by all, belong to all; nor can any one man, or any set of men, lay claim to them when still continuing in a state of nature.

I never walked out about the environs of Paris, that I did not consider the immense quantity of game that was running almost tame on every side of me, as a badge of the slavery of the people; and what they wished me to observe as an object of triumph, I always regarded with a kind of secret compassion: yet this people have no game-laws for the remoter parts of the kingdom; the game is only preserved in a few places for the king, and is free in most places else. In England the prohibition is general; and the peasant has not a right to what even slaves, as he is taught to call them, are found to possess.

Of partridges there are two kinds; the gray and the red.² The red partridge is the largest of the two, and often perches upon trees; the gray, with which we are best acquainted in England, is most prolific, and always keeps on the ground.

² Modern ornithologists have ascertained many more varieties of partridges. The Greek partridge is more bulky than the red, with which it has frequently been confounded.—ED.

The partridge seems to be a bird well known all over the world, as it is found in every country and in every climate; as well in the frozen regions about the pole, as the torrid tracts under the equator. It even seems to adapt itself to the nature of the climate where it resides. In Greenland, the partridge, which is brown in summer, as soon as the icy winter sets in, begins to take a covering suited to the season: it is then clothed with a warm down beneath; and its outward plumage assumes the colour of the snows among which it seeks its food. Thus it is doubly fitted for the place, by the warmth and the colour of its plumage; the one to defend it from the cold, the other to prevent its being noticed by the enemy. Those of Barakonda, on the other hand, are longer-legged, much swifter of foot, and choose the highest precipices and rocks to reside in.

They all, however, agree in one character, of being immoderately addicted to venery; and, as some writers affirm, often to an unnatural degree. It is certain the male will pursue the hen even to her nest; and will break her eggs rather than not indulge his inclinations. Though the young ones have kept together in flocks during the winter, when they begin to pair in spring, their society disperses, and combats, very terrible with respect to each other, ensue. Their manners, in other circumstances, resemble all those of poultry in general; but their cunning and instincts seem superior to those of the larger kinds. Perhaps, as they live in the very neighbourhood of their enemies, they have more frequent occasion to put their little arts in practice; and learn, by habit, the means of evasion or safety. Whenever, therefore, a dog, or other formidable animal, approaches their nest, the female uses every means to draw him away. She keeps just before him, pretends to be incapable of flying, just hops up, and then falls down before him, but never goes off so far as to discourage her pursuer. At length, when she has drawn him entirely away from her secret treasure, she at once takes wing, and fairly leaves him to gaze after her in despair.

After the danger is over, and the dog withdrawn, she then calls her young, who assemble at once at her cry, and follow where she leads them. There are generally from ten to fifteen in a covey; and, if unmolested, they live from fifteen to seventeen years.

There are several methods of taking them, as is well known; that by which they are taken in a net with a setting dog, is the most pleasant, as well as the most secure. The dog, as everybody knows, is trained to this exercise by a long course of education; by blows and caresses he is taught to lie down at the word of command; a partridge is shown him, and he is then ordered to lie down: he is brought into the field, and when the sportsman perceives where the covey lies, he orders his dog to crouch: at length the dog,

from habit, crouches whenever he approaches a covey; and this is the signal which the sportsman receives for unfolding, and covering the birds with his net. A covey thus caught, is sometimes fed in a place proper for their reception; but they can never be thoroughly tamed, like the rest of our domestic poultry.

CHAP. X.

THE QUAIL.

THE last of the poultry kind that I shall mention, is the quail; a bird much smaller than any of the former, being not above half the size of a partridge. The feathers of the head are black, edged with rusty brown; the breast is of a pale yellowish red, spotted with black; the feathers on the back are marked with lines of a pale yellow, and the legs are of a pale hue. Except in the colours thus described, and the size, it every way resembles a partridge in shape; and, except that it is a bird of passage, all others of the poultry kind, in its habits and nature.

The quail is by all known to be a bird of passage; and yet if we consider its heavy manner of flying, and its dearth of plumage, with respect to its corpulence, we shall be surprised how a bird so apparently ill-qualified for migration, should take such extensive journeys. Nothing, however, is more certain: "When we sailed from Rhodes to Alexandria," says Bellonius, "about autumn, many quails, flying from the north to the south, were taken in our ship; and sailing at spring-time, the contrary way, from the south to the north, I observed them on their return, when many of them were taken in the same manner." This account is confirmed by many others; who aver, that they choose a north wind for these adventures; the south wind being very unfavourable, as it retards their flight, by moistening their plumage. They then fly two by two; continuing, when their way lies over land, to go faster by night than by day; and to fly very high, to avoid being surprised or set upon by birds of prey. However, it still remains a doubt whether quails take such long journeys as Bellonius has made them perform. It is now asserted by some, that the quail only migrates from one province of a country to another. For instance, in England they fly from the inland counties to those bordering on the sea, and continue there all the winter. If frost or snow drive them out of the stubble-field or marches, they then retreat to the sea-side, shelter themselves among the weeds, and live upon what is thrown up from the sea upon shore. Particularly in Essex, the time of their appearance upon the coasts of that county exactly coincides with their disappearance from the more internal parts of the kingdom; so that what has been said of their long

flights is probably not so well founded as is generally supposed.

These birds are much less prolific than the partridge; seldom laying more than six or seven whitish eggs, marked with ragged rust-coloured spots. But their ardour in courtship yields scarcely to any other bird, as they are fierce and cruel at that season to each other, fighting most desperately, and (a punishment they richly deserve) being at that time very easily taken. Quail-fighting was a favourite amusement among the Athenians: they abstained from the flesh of this bird, deeming it unwholesome, as supposing that it fed upon the white hellebore: but they reared great numbers of them, for the pleasure of seeing them fight; and staked sums of money, as we do with regard to cocks, upon the success of the combat. Fashion, however, has at present changed with regard to this bird; we take no pleasure in its courage, but its flesh is considered as a very great delicacy.

Quails are easily caught by a call: the fowler, early in the morning, having spread his net, hides himself under it among the corn; he then imitates the voice of the female with his quail-pipe, which the cock hearing, approaches with the utmost assiduity; when he has got under the net, the fowler then discovers himself, and terrifies the quail, who attempting to get away, entangles himself the more in the net, and is taken. The quail may thus very well serve to illustrate the old adage, that every passion, carried to an inordinate excess, will at last lead to ruin.

SUPPLEMENTARY NOTE.

This genus was instituted by Mr. Stephens, in his continuation of 'Shaw's General Zoology,' for the reception of such of the partridges as had thick bills. These are only found in North and South America. They frequent the borders of woods, and reside among brushwood, or in plains where the grass is thick and high, or among grain in fields which are cultivated. If disturbed they fly to trees, where they perch for safety, and "walk with ease on the branches," according to Audubon; who says they perform occasional migrations from north-west to south-east, usually in the beginning of October, and somewhat in the manner of the wild turkey. The Virginian quail (*Ortyx Virginiana*) abounds in the Eastern and Middle states of America, and is to be found in most districts of the Union, where it is called 'the Partridge.' It emigrates about the beginning of October, at which time, the north-eastern shores of the Ohio are literally covered with them. During these excursions, they frequently fall into the water, and many of them perish, but if they drop at no great distance from the land, they easily reach the shore by swimming, which Audubon affirms they can do "surprisingly." If Virginian quails are molested, they take refuge in trees, always resorting to the middle branches; and if they think they are noticed by the sportsman, they erect the feathers on the crown of their head, emit a low note, and escape to another part of the tree, or to a more distant one. When they take to flight without being disturbed, the whole covey pursue the same course; but when frightened they disperse in various directions, and after having alighted call to each other, and are soon congregated by the note of the patriarch-bird of the

flock. The nest of this bird is of a circular form, in which it leaves an aperture not unlike in shape to that of a common oven. It is placed at the side of a thick tuft of grass, and is partly sunk in the ground. The female lays from ten to eighteen pure white eggs; and is assisted by the male in the tedious operation of incubation. They only rear one breed during a year. Their manner of reposing at night is rather curious, as mentioned by Audubon. He says, "the partridge rests at night on the ground, either amongst the grass or under a bent log. The individuals which compose the flock form a ring, and moving backwards, approach each other until their bodies are nearly in contact. This arrangement enables the whole covey to take wing when suddenly alarmed, each flying off in a direct course, so as not to interfere with the rest." The flesh of this bird is considered a delicate and agreeable food.

The Californian quail (*O. Californica*) was first noticed by an editor of the voyage of the unfortunate *La Pérouse*, who also figured them in the plates illustrating that work. They are known to assemble in flocks of two or three hundreds in the low woods and plains of California. The flesh is said to be of a fine flavour. These quails are easily tamed, and soon become quite reconciled to a state of captivity. They are birds of an elegant bearing, the crests giving them a fine and striking appearance.

Quails are found in most part of Great Britain, but nowhere in great quantity. The time of their migration from this country is August or September: they are supposed to winter in Africa; and they return early in the spring. At their arrival in Alexandria such multitudes are exposed in the markets for sale that three or four may be bought for a medina, a coin less than three farthings in value. Crews of merchant vessels have been fed upon them; and complaints have sometimes been laid at the consul's office, by mariners against their captains for giving them nothing but quails to eat. With wind and weather in their favour, they have been known to perform a flight of fifty leagues across the Black Sea in the course of a night; a wonderful distance for so short-winged a bird. Such prodigious quantities have

appeared on the western coast of the kingdom of Naples, in the vicinity of Netuno, that a hundred thousand have, in one day, been caught within the space of three or four miles. Most of them are taken to Rome, where they are in great request, and are sold at extremely high prices.—Clouds of quails also alight, in spring, along the coasts of Provence; especially in the lands belonging to the bishop of Frejus, which borders on the sea. Here they are sometimes found so exhausted, that for a few of the first days they may be taken with the hand. In some parts of the south of Russia they abound so greatly, that at the time of their migration they are caught by thousands, and sent in casks to Moscow and Petersburg.

In peaceful times we import great quantities of these birds from France, for the table; all of which are males. They are conveyed by stage coaches, in a large square box, divided into five or six compartments, one above another, just high enough to admit the quails to stand upright, and each box containing about a hundred birds. Were they allowed a greater height than this, they would soon kill themselves; and even with this precaution, the feathers of the top of the head are generally beaten off. These boxes have wire on the fore-part, and each partition is furnished with a small trough for food. They may be forwarded in this manner, without difficulty, to great distances.

With respect to these birds having a distinct knowledge of the precise time for emigration, we have a very singular fact in some young quails, which having been bred in cages from the earliest part of their lives, had never enjoyed and therefore could not feel the loss of liberty. For four successive years they were observed to be restless, and to flutter with unusual agitations regularly in September and April; and this uneasiness lasted thirty days at each time. It began constantly an hour before sunset. The birds passed the whole night in these fruitless struggles, and always on the following day appeared dejected and stupid.

There are above twenty species of quails

BOOK V.

OF BIRDS OF THE PIE KIND.

CHAP. I.

OF BIRDS OF THE PIE KIND.

IN marshalling our army of the feathered creation, we have placed in the van a race of birds long bred to war, and whose passion is slaughter; in the centre we have placed the slow and heavy laden, that are usually brought into the field to be destroyed; we now come to a kind of light infantry, that partake something of the spirit of the two former, and yet belonging to neither. In this class we must be content to marshal a numerous irregular tribe, variously armed, with different pursuits, appetites, and manners; not

formidably formed for war, and yet generally delighting in mischief; not slowly and usefully obedient, and yet without any professed enmity to the rest of their fellow-tenants of the air.

To speak without metaphor; under this class of birds we may arrange all that noisy, restless, chattering, teasing tribe, that lies between the hen and the thrush, that, from the size of the raven down to that of the woodpecker, flutter round our habitations, and rather with the spirit of pilferers than of robbers, make free with the fruits of human industry.

Of all the other classes, this seems to be that which the least contributes to furnish out the pleasures, or supply the necessities of man. The

falcon hunts for him; the poultry tribe supplies him with luxurious food; and the little sparrow race delight him with the melody of their warblings. The crane kind make a studied variety in his entertainments; and the class of ducks are not only many of them delicate in their flesh, but extremely useful for their feathers. But in the class of the pie kind, there are few, except the pigeon, that are any way useful. They serve rather to tease man, than to assist or amuse him. Like faithless servants, they are fond of his neighbourhood, because they mostly live by his labour; but their chief study is what they can plunder in his absence, while their deaths make no atonement for their depredation.

But though, with respect to man, this whole class is rather noxious than beneficial; though he may consider them in this light, as false, noisy, troublesome neighbours, yet, with respect to each other, no class of birds are so ingenious, so active, or so well-fitted for society. Could we suppose a kind of morality among birds, we should find that these are by far the most industrious, the most faithful, the most constant, and the most connubial. The rapacious kinds drive out their young before they are fit to struggle with adversity; but the pie kind cherish their young to the last. The poultry class are faithless and promiscuous in their courtship; but these live in pairs, and their attachments are wholly confined to each other. The sparrow kind frequently overleap the bounds of nature, and make illicit varieties; but these never. They live in harmony with each other; every species is true to its kind, and transmits an unpolluted race to posterity.

As other kinds build in rocks or upon the ground, the chief place where these build is in trees or bushes; the male takes his share in the labours of building the nest, and often relieves his mate in the duties of incubation. Both take this office by turns; and when the young are excluded, both are equally active in making them an ample provision.

They sometimes live in societies; and in these there are general laws observed, and a kind of republican form of government established among them. They watch not only for the general safety, but for that of every other bird of the grove. How often have we seen a fowler, stealing in upon a flock of ducks or wild geese, disturbed by the alarming note of a crow or a magpie: its single voice gave the whole thoughtless tribe warning, and taught them in good time to look to their safety.

Nor are these birds less remarkable for their instincts than their capacity for instruction. There is an apparent cunning or archness in the look of the whole tribe; and I have seen crows and ravens taught to fetch and carry with the docility of a spaniel. Indeed, it is often an exercise that, without teaching, all this tribe are but too fond of. Everybody knows what a pas-

sion they have for shining substances, and such toys as some of us put a value upon. A whole family has been alarmed at the loss of a ring; every servant has been accused, and every creature in the house, conscious of their own innocence, suspected each other; when, to the utter surprise of all, it has been found in the nest of a tame magpie or a jackdaw, that nobody had ever thought of.

However, as this class is very numerous, it is not to be supposed that the manners are alike in all. Some, such as the pigeon, are gentle and serviceable to man; others are noxious, capricious, and noisy. In a few general characters they all agree; namely, in having hoarse voices, slight active bodies, and a facility of flight that baffles even the boldest of the rapacious kinds in the pursuit. I will begin with those birds which most properly may be said to belong to this class, and go on till I finish with the pigeon, a harmless bird, that resembles this tribe in little else except their size, and that seems to be the shade uniting the pie and the sparrow kind into one general picture.

It is not to be expected that in this sketch of the great magazine of nature, we can stop singly to contemplate every object. To describe the number that offers would be tedious, and the similitude that one bears to another would make the history disgusting. As a historian, in relating the actions of some noble people, does not stop to give the character of every private man in the army, but only of such as have been distinguished by their conduct, courage, or treachery; so should the historian of nature only seize upon the most striking objects before him; and having given one common account of the most remarkable, refer the peculiarities of the rest to their general description.

CHAP. II.

OF THE RAVEN, THE CROW, AND THEIR AFFINITIES.

THE Raven, the Carrion-crow, and the Rook, are birds so well known, that a long description would but obscure our ideas of them. The raven is the largest of the three, and distinguished from the rest not only by his size, but by his bill being somewhat more hooked than that of the rest. As for the carrion-crow and the rook, they so strongly resemble each other in make and size, that they are not easily distinguished asunder. The chief difference to be found between them lies in the bill of the rook; which, by being frequently thrust into the ground to fetch out grubs and earth-worms, is bare of feathers as far as the eyes, and appears of a whitish colour. It differs also in the purple splendour or gloss of its feathers, which in the carrion-crow are of a dirty black. Nor is it amiss to make these dis-

tinctions, as the rook has but too frequently suffered for its similitude to the carrion-crow; and thus a harmless bird, that feeds only upon insects and corn, has been destroyed for another that feeds upon carrion, and is often destructive among young poultry.

The manners of the raven and the carrion-crow are exactly similar; they both feed upon carrion; they fly only in pairs; and will destroy other birds, if they can take them by surprise. But it is very different with the rook, the daw, and the Cornish chough, which may be all ranked in this order. They are sociable and harmless; they live only upon insects and grain; and wherever they are, instead of injuring other birds, they seem sentinels for the whole feathered creation. It will be proper, therefore, to describe these two sorts according to their respective appetites, as they have nothing in common but the very strong similitude they bear to each other in their colour and formation.

The raven is a bird found in every region of the world; strong and hardy, he is uninfluenced by the changes of the weather; and when other birds seem numbed with cold, or pining with famine, the raven is active and healthy, busily employed in prowling for prey, or sporting in the coldest atmosphere. As the heats at the line do not oppress him, so he bears the cold of the polar countries with equal indifference. He is sometimes indeed seen milkwhite; and this may probably be the effect of the rigorous climates of the north. It is most likely that this change is wrought upon him as upon most other animals in that part of the world, where their robes, particularly in winter, assume the colour of the country they inhabit. As in old age, when the natural heat decays, the hair grows gray, and at last white; so among these animals the cold of the climate may produce a similar languishment of colour, and may shut up those pores that conveyed the tincturing fluids to the extremest parts of the body.

However this may be, white ravens are often shown among us, which I have heard some say, are rendered thus by art; and this we could readily suppose, if they were as easily changed in their colour as they are altered in their habits and dispositions. A raven may be reclaimed to almost every purpose to which birds can be converted.¹ He may be trained up for fowling like

¹ In the year 1785, a gentleman going into the Red Lion inn, at Hungerford, his chaise ran over, and sorely bruised the leg of his Newfoundland dog. Whilst examining the injury, and bathing the wound, a raven which belonged to the people of the house, attended, and was, apparently, a much concerned spectator. The dog's leg being dressed, he was tied up in the manger, where Ralph not only immediately visited him but brought him bones, and attended him with repeated marks of attention. The bird's notice of the dog was so very extraordinary that the gentleman questioned the hostler concerning the affair, who informed him, that the raven had been bred

a hawk; he may be taught to fetch and carry like a spaniel; he may be taught to speak like a parrot; but the most extraordinary of all is, that he can be taught to sing like a man. I have heard a raven sing 'the Black Joke' with great distinctness, truth, and humour.²

Indeed, when the raven is taken as a domestic, he has many qualities that render him extremely amusing. Busy, inquisitive, and impudent, he goes everywhere; affronts and drives off the dogs, plays his pranks on the poultry, and is particularly assiduous in cultivating the goodwill of the cook-maid, who seems to be the favourite of the family. But then, with the amusing qualities of a favourite, he often also has the vices and defects. He is a glutton by nature, and a thief by habit. He does not confine himself to petty depredations on the pantry or the larder; he soars at more magnificent plunder; at spoils that he can neither exhibit nor enjoy; but which, like a miser, he rests satisfied with

from his pin-feather in intimacy with a dog, and that the affection was mutual. Ralph's poor dog, by some accident, had also got his leg broken; and during the long time he was confined, his friend waited upon him, constantly carrying him provisions, and scarcely ever quitting him. One night, by accident, the hostler had shut the stable-door, and Ralph was deprived of the company of his friend the whole night; but the hostler found, in the morning, the bottom of the door so pecked, that had it not been opened, Ralph would in another hour have made himself an entrance. The gentleman then inquired of the people of the house, who confirmed the above account, with several other traits of kindness which this bird had shown to all dogs in general; but particularly to maimed or wounded ones.—Ed.

² At the seat of the earl of Aylesbury, in Wiltshire, a tame raven, that had been taught to speak, used to ramble about in the park. There he was commonly attended and beset with crows, rooks, and others of his inquisitive tribe. When a considerable number of these were collected round him, he would lift up his head, and with a hoarse and hollow voice shout out the word *Holla!* This would instantly put to flight and disperse his sable brethren; while the raven seemed to enjoy the fright he had occasioned. Mr. Johnstone of Hill-House, near Holyrood, possesses a raven which he has reared from the nest, whence he was taken upwards of twenty-three years ago, who, like many of his captive brethren, is celebrated for his talking propensities, and especially for the distinctness with which, when interrogated concerning the illustrious generals of our time, he pronounces the name of his great name-father, not only in his native dialect, good broad Scotch, but also, at the pleasure of his interlocutor, both in a pure English, and genuine Irish accent. We are likewise informed that he barks so successfully that his voice can scarcely be distinguished from that of a good watchdog. He possesses, too, all the pugnacity of his species. At one time an owl was made the companion of his solitude, which, after a few days endurance, he slew and devoured; a common rook was next tried; and, for a few weeks, he seemed pleased with his associate, but it soon also shared the fate of the owl. He has this peculiarity, that the second primary feather of both wings is of a pure white colour, so that he is pie-bald, a trait not very uncommon in his race, some of whom have been noticed wholly white.—Ed.

having the satisfaction of sometimes visiting and contemplating in secret. A piece of money, a tea-spoon, or a ring, are always tempting baits to his avarice; these he will slyly seize upon, and, if not watched, will carry to his favourite hole.

In his wild state, the raven is an active and greedy plunderer. Nothing comes amiss to him; whether his prey be living or long dead it is all the same, he falls to with a voracious appetite; and, when he has gorged himself, flies to acquaint his fellows, that they may participate of the spoil. If the carcass be already in the possession of some more powerful animal, a wolf, a fox, or a dog, the raven sits at a little distance, content to continue an humble spectator till they have done. If in his flights he perceives no hopes of carrion, and his scent is so exquisite that he can smell it at a vast distance, he then contents himself with more unsavoury food, fruits, insects, and the accidental dessert of a dunghill.

This bird chiefly builds its nest in trees, and lays five or six eggs of a pale green colour, marked with small brownish spots. They live sometimes in pairs, and sometimes they frequent, in great numbers, the neighbourhood of populous cities, where they are useful in devouring those carcasses that would otherwise putrefy and infect the air. They build in high trees or old towers, in the beginning of March with us in England, and sometimes sooner, as the spring is more or less advanced for the season. But it is not always near towns that they fix their retreats; they often build in unfrequented places, and drive all other birds from their vicinity. They will not permit even their young to keep in the same district, but drive them off when they are sufficiently able to shift for themselves. Martin, in his description of the Western Isles, avers, that there are three little islands among the number, which are occupied by a pair of ravens each, that drive off all other birds with great cries and impetuosity.

Notwithstanding the injury these birds do in picking out the eyes of sheep and lambs, when they find them sick and helpless, a vulgar respect is paid them as being the birds that fed the prophet Elijah in the wilderness. This prepossession in favour of the raven is of very ancient date, as the Romans themselves, who thought the bird ominous, paid it, from motives of fear, the most profound veneration. One of these that had been kept in the temple of Castor, as Pliny informs us, flew down into the shop of a tailor, who took much delight in the visits of his new acquaintance. He taught the bird several tricks; but particularly to pronounce the names of the emperor Tiberius, and the whole royal family. The tailor was beginning to grow rich by those who came to see this wonderful raven, till an envious neighbour, displeased at the tailor's success, killed the bird, and deprived the tailor of his future hopes of fortune. The

Romans, however, took the tailor's part; they punished the man who offered the injury, and gave the raven all the honours of a magnificent interment.

Birds in general live longer than quadrupeds; and the raven is said to be one of the most long-lived of the number. Hesiod asserts, that a raven will live nine times as long as a man; but though this is fabulous, it is certain that some of them have been known to live near a hundred years. This animal seems possessed of those qualities that generally produce longevity, a good appetite, and great exercise. In clear weather, the ravens fly in pairs to a great height, making a deep loud noise, different from that of their usual croaking.³

The carrion-crow resembles the raven in its appetites, its laying, and manner of bringing up its young. It only differs in being less bold, less docile, and less favoured by mankind.⁴

³ See Supplementary Note A, p. 82.

⁴ See Supplementary Note B, p. 84.—“The hooded crow, or *hoodie*, is the carrion crow of Scotland; but whether identical with the English bird of that name, is doubtful. It is not migratory, like the carrion crow of England, but is found at all seasons on most of the headlands and rocky shores of the Highland lochs and Western and Northern islands. In these places it does not breed in trees, as in England; for there are no trees; but it makes its nest in precipitous crags. It is the habit of this bird, as of the eagle, that one pair appropriate to themselves a breeding-place, and drive away all intruders. If one of the mates be killed, another very speedily appears and takes its place. In like manner, two or three pairs of *hoodies* appropriate a district of coast or an island, the numbers being always limited to the means of subsistence. These do not fight among themselves, but prevent strangers from encroaching on their feeding-grounds. The boldness, rapacity, and cunning of the hooded crow are very remarkable. Two gentlemen, on a visit to Barra-Head light-house, observed to the light-keeper there, that a fine-looking domestic cock had lost the feathers of his neck. ‘That,’ said he, ‘is the consequence of fighting with the hoodie crows in defence of his hens, which the hoodies would kill and devour.’ He added, that even the lighthouse dog was not a match for the hoodies, but on him they practised cunning bearing the stamp of reasoning. When the dog had got a bone, and was couching with it between his paws, one hoodie was observed to come in front, and another to approach behind; the one in front of the dog manœuvred impudently, till the indignant cur, losing temper, left his bone and made a spring forward at the presumptuous bird; at this moment, the accomplice crow from behind instantly struck in and flew off in triumph with the prize!”—*Dr. Neill*.

Mr. Hogg, in a communication to the editor of ‘The Edinburgh Journal of Natural History,’ from Stobo-hope, Peebles-shire, in January 1838, says: “In a former communication, which you have inserted in your ‘History of British Birds,’ I told you of two carrion crows that for upwards of twenty years have inhabited the ground of which I have charge. In this glen is a small meadow irrigated from the stream which runs along its bottom. On the brink of its principal head I noticed my old friends busy eating, and thinking it might be some part of a sheep, I made towards them, and found them standing with their heads towards each other, pecking with all their might at something that lay between them. In

The rook leads the way in another, but a more harmless train, that have no carnivorous appetites, but only feed upon insects and corn.⁵ The Royston (or hooded) crow is about the size of the two former. The breast, belly, back, and upper part of the neck, being of a pale ash-colour; the head and wings glossed over with a fine blue. He is a bird of passage, visiting this kingdom in the beginning of winter, and leaving it in the spring. He breeds, however, in different parts of the British dominions; and his nest is common enough in trees in Ireland. The jackdaw is black, like all the former, but ash-coloured on the breast and belly. He is not above the size of a pigeon. He is docile and loquacious. His head is large for the size of his body, which, as has been remarked, argues him ingenious and crafty. He builds in steeples, old castles, and high rocks, laying five or six eggs in a season. The Cornish chough is like a jackdaw, but bigger, and almost the size of a crow. The bill, feet, and legs, are long like those of a jackdaw, but of a red colour; and the plumage is black all over. It frequents rocks, old castles, and churches by the sea-side, like the daw; and with the same noisy assiduity. It is only seen along

their eagerness, they sometimes tossed it athwart, to obtain mouthfuls. When I went near, one of them carried off the remainder of the feast in his bill. I found neither wool nor feathers, however, bones nor entrails, nothing, in short, but a little blood on the snow; but on a more minute inspection, I observed a small trail, as if something had been pulled out of the lead, and the marks of some drops of water that had been splashed out and sunk among the snow. I could make no more of it, and so left it, carelessly thinking it might have been a water-mouse which they had seized in a fit of desperate hunger. A day or two after, I fell in with Sir James Montgomery's man, who has charge of the watered meadows, ditches, and drains, and told him of the circumstance, when he assured me that he had oftener than once surprised the carrion crows devouring fish, taken in the meadows, and that one time they had eaten all but the bones of the head. The reason why this happens in a meadow is as follows. To irrigate a meadow rightly, the water must be taken off at times, and on the occurrence of certain changes in the state of the air. During the time that it is flooded, small fish or trouts sail down the principal lead, then distribute themselves along the small canals where sustenance for them abounds. When the water is instantaneously let off, the poor trouts can find protection nowhere from the heron, who diligently searches all the sinks and shallows of the half-dried pool. But I had no conception of the carrion crows taking and feeding on fish; this I thought had been a prerogative of fowls and other animals whose structure adapted them for searching in and under water. I had no doubt, when I considered the omnivorous nature of this crow, however, that if it found a dead fish, it would readily eat it up; but that it would plunge into the water, and seize a fish swimming deep, I could not have supposed; yet this had certainly been done on this occasion, for the water out of which they had dragged the fish was rather more than a foot deep, and on taking a second look of the place, I found that no protection could be afforded to the trouts, as there were neither stones nor hanging banks."—Ed.

⁵ See Supplementary Note B, p. 84.

the western coasts of England. These are birds very similar in their manners, feeding on grain and insects, living in society, and often suffering general castigation from the flock for the good of the community.

The rook, as is well known, builds in woods and forests in the neighbourhood of man, and sometimes makes choice of groves in the very midst of cities for the place of its retreat and security. In these it establishes a kind of legal constitution, by which all intruders are excluded from coming to live among them, and none suffered to build but acknowledged natives of the place. I have often amused myself with observing their plan of policy from my window in the Temple, that looks upon a grove where they have made a colony in the midst of the city. At the commencement of spring, the rookery, which during the continuance of winter seemed to have been deserted, or only guarded by about five or six, like old soldiers in a garrison, now begins to be once more frequented; and in a short time all the bustle and hurry of business is fairly commenced. Where these numbers resided during the winter is not easy to guess; perhaps in the trees of hedge-rows, to be nearer their food. In spring, however, they cultivate their native trees; and, in the places where they were themselves hatched, they prepare to propagate a future progeny.⁶

⁶ In the year 1783, a pair of rooks, after an unsuccessful endeavour to establish themselves in a rookery, at no great distance from the Royal Exchange of Newcastle, were compelled to abandon the attempt, and take refuge in the spire of that building; and although constantly interrupted by other rooks, they built their nest on the top of the vane, and reared their young, undisturbed by the noise of the populace below them; the nest and its inhabitants were of course turned about by every change of the wind. They returned and built their nest every year on the same place, till the year 1793; soon after which the spire was taken down. A small copper-plate was engraved, the size of a watch-paper, with a representation of the top of the spire, and the nest; and so much pleased were the inhabitants and other persons with it, that as many copies were sold as produced the engraver the sum of ten pounds.

A remarkable circumstance respecting these birds occurred, some years ago, at Dallam-Tower, in Westmoreland, the seat of Daniel Wilson, Esq. There were two groves adjoining to the park; one of which had for many years been the resort of a number of herons, that regularly every year built and bred there: in the other was a very large rookery. For a long time the two tribes had lived peaceably together. At length, in the spring of 1775, the trees of the heronry were cut down, and the young brood perished by the fall of the timber. The parent-birds, not willing to be driven from the place, endeavoured to effect a settlement in the rookery. The rooks made an obstinate resistance; but after a desperate contest, in the course of which many of the rooks and some of the herons lost their lives, the latter at length succeeded in obtaining possession of some of the trees, and that very spring built their nests afresh. The next season a similar contest took place, which, like the former, terminated by the victory of the herons. After that time peace seemed to be agreed upon be

They keep together in pairs; and when the offices of courtship are over, they prepare for making their nests and laying. The old inhabitants of the place are all already provided; the nest which served them for years before, with a little trimming and dressing will serve very well again; the difficulty of nestling lies only upon the young ones, who have no nest, and must, therefore, get up one as well as they can. But not only the materials are wanting, but also the place in which to fix it. Every part of a tree will not do for this purpose, as some branches may not be sufficiently forked, others may not be sufficiently strong, and still others may be too much exposed to the rockings of the wind. The male and female upon this occasion are, for some days, seen examining all the trees of the grove very attentively; and when they have fixed upon a branch that seems fit for their purpose, they continue to sit upon and observe it very sedulously for two or three days longer. The place being thus determined upon, they begin to gather the materials for their nest; such as sticks and fibrous roots, which they regularly dispose in the most substantial manner. But here a new and unexpected obstacle arises. It often happens that the young couple have made choice of a place too near the mansion of an older pair, who do not choose to be incommoded by such troublesome neighbours. A quarrel therefore instantly ensues, in which the old ones are always victorious.

The young couple, thus expelled, are obliged again to go through the fatigues of deliberating, examining, and choosing; and having taken care to keep their due distance, the nest begins again, and their industry deserves commendation. But their alacrity is often too great in the beginning; they soon grow weary of bringing the materials of their nest from distant places; and they very easily perceive that sticks may be provided nearer home, with less honesty indeed, but some degree of address. Away they go, therefore, to pilfer, as fast as they can; and whenever they see a nest unguarded, they take care to rob it of the very choicest sticks of which it is composed. But these thefts never go unpunished; and probably upon complaint being made there is a general punishment inflicted. I have seen eight or ten rooks come upon such occasions, and, setting upon the new nest of the young couple all at once, tear it in pieces in a moment.

At length, therefore, the young pair find the necessity of going more regularly and honestly to work. While one flies to fetch the materials, the other sits upon the tree to guard it; and thus in the space of three or four days, with a skirmish now and then between, the pair have fitted up a commodious nest, composed of sticks

tween them. The rooks relinquished part of the grove to the herons, to which part alone they confined themselves; and the two communities appeared to live together in as much harmony as they did before the dispute.—Ed.

without, and of fibrous roots and long grass within. From the instant the female begins to lay, all hostilities are at an end; not one of the whole grove, that a little before treated her so rudely, will now venture to molest her; so that she brings forth her brood with patient tranquillity. Such is the severity with which even native rooks are treated by each other; but if a foreign rook should attempt to make himself a denizen of their society, he would meet with no favour; the whole grove would at once be up in arms against him, and expel him without mercy.

In some countries these birds are considered as a benefit, in others as a nuisance: their chief food is the worm of the dor-beetle, and corn; thus they may be said to do as much service by destroying that noxious insect, as they do injury by consuming the produce of the husbandman's industry.⁷

To this tribe of the crow-kind, some foreign sorts might be added:⁸ I will take notice only of one, which, from the extraordinary size and fashion of his bill, must not be passed in silence. This is the Calao, or horned Indian raven, which exceeds the common raven in size and habits of depredation. But what he differs in from all other birds is the beak, which by its length and curvature at the end, appears designed for rapine; but then it has a kind of horn standing out from the top, which looks somewhat like a second bill, and gives this bird, otherwise fierce and ugly, a very formidable appearance. The horn springs out of the forehead, and grows to the upper part of the bill, being of great bulk; so that near the forehead it is four inches broad, not unlike the horn of the rhinoceros, but more crooked at the tip. Were the body of the bird answerable in size to the head, the calao would exceed in magnitude even the vulture or the eagle. But the head and beak are out of all proportion, the body being not much larger than that of a hen. Yet even here there are varieties; for in such of those birds as come from different parts of Africa, the body is proportionable to the beak; in such as come from the Molucca Islands, the beak bears no proportion to the body. Of what use this extraordinary excrescence is to the bird, is not easy to determine; it lives, like others of its kind, upon carrion, and seldom has a living enemy to cope with: Nature seems to sport in the production of many animals, as if she were willing to exhibit instances as well of variety as economy in their formation.

⁷ See Supplementary Note C, p. 87.

⁸ There are also the Fish crow, which lives on dead fish and other garbage by the river and sea shore, and Clark's crow, which resembles somewhat the jackdaw, both described by Wilson in his 'Ornithology.'—Ed.

NOTE A.—The Raven.

This species, which is the largest of the crow-family resident in Britain, with a grave and dignified

air, combines much cunning, and in courage is little inferior even to some of the rapacious birds. Its body is of an ovate form, rather bulky; the neck strong, and of a moderate length; the head large and oblong; the bill rather long, deep, and nearly straight; the feet of moderate length and ordinary strength. The plumage is compact and highly glossed; the wings long and much rounded; as is the tail. The bill and feet are black; the plumage deep black, with splendid reflections of rich purplish-blue. The length of the male is twenty-six inches, and its extended wings measure fifty-two.

The raven is a remarkably grave and sedate bird, and, unlike many men who assume an aspect of dignity, is equally noted for sagacity and prudence. It is crafty, vigilant, and shy, so as to be with great difficulty approached, unless in the breeding season, when its affectionate concern for its young, in a great measure, overcomes its habitual dislike to the proximity of man; a dislike which is the result of prudence more than of mere timidity; for, under particular circumstances, it will not hesitate to make advances which a timorous bird would, no doubt, deem extremely hazardous. It eats from off the same carcass as a dog, and takes its station close to an otter devouring its prey, doubtless because its vigilance and activity suffice to enable it to elude their efforts to inflict injury upon it; and while it yields to the eagle, it drives away the hooded crow and the gull. It knows the distance, too, at which it is safe from a man armed with a gun, and allows the shepherd and his dogs to come much nearer than the sportsman. It never ventures to attack a man plundering its nest, and rarely pretends to be crippled, in order to draw him away from it, but stands at a distance, looking extremely dejected, or flies over and around him, uttering now and then a stifled croak indicative of anger and anxiety.

When searching for food on the ground, it generally walks with a steady and measured pace; but under excitement, it occasionally leaps, using its wings at the same time, as when driven from carrion by a dog, or when escaping from its fellows with a fragment of flesh or intestine. Its flight is commonly steady and rather slow, and is performed by regularly timed beats of its extended wings; but it can urge its speed to a great degree of rapidity, so as to overtake an eagle, or even a hawk, when passing near its nest. In fine weather it often soars to a vast height, in the manner of the birds just mentioned, and floats, as it were, at ease, high over the mountain tops. Some naturalists having observed birds thus engaged, have imagined them to be searching for food, and have consequently amused their readers with marvellous accounts of the distances at which the eagle can spy its prey; but had they patiently watched, they might have found that the quiet soarings of the raven and the rapacious species have no reference to prey. On the other hand, it may sometimes be observed gliding along, and every now and then shifting its course, in the heaviest gales, when scarcely another bird can be seen abroad. Although there is not much reason for calling it "the tempest-loving raven," it would be a severe storm indeed that would keep it at home, when a carcass was in view.

In the Hebrides, where this bird is much more abundant than in any other part of Britain, it may be seen either singly or in pairs, searching for food, along the rocky shores, on the sandfords, the sides of the hills, the inland moors, and the mountain tops. It flies at a moderate height, proceeding rather slowly, deviating to either side, sailing at intervals, and seldom uttering any sound. When it has discovered a dead sheep, it alights on a stone, a peat bank, or other eminence, folds up its wings, looks around, and croaks. It then advances nearer, eyes its prey with attention, leaps upon it, and, in a half-crouch-

ing attitude, examines it. Finding matters as it wished, it croaks aloud, picks out an eye, devours part of the tongue, if that organ be protruded; and, lastly, attacks the abdomen. By this time another raven has usually come up. They perforate the skin, drag out and swallow portions of the intestines, and continue to feast until satiated or disturbed. Sometimes, especially should it be winter, they are joined by a black-backed gull, or even a herring-gull, which, although at first shy, are allowed to come in for a share of the plunder; but should an eagle arrive, both they and the gulls retire to a short distance, the former waiting patiently, the latter walking backwards and forwards, uttering plaintive cries, until the intruder departs. When the carcass is that of a larger animal than a sheep, they do not, however, fly off, although an eagle, or even a dog, should arrive. These observations were made by the writer, when lying in wait in little huts constructed for the purpose of shooting eagles and ravens from them. The latter were allowed to remain unmolested for hours, that they might attract the former to the carrion; and in this manner, he was enabled to watch their actions when they were perfectly unrestrained.

Although the raven is omnivorous, its chief food is carrion, by which is here meant the carcasses of sheep, horses, cattle, deer, and other quadrupeds; dolphins and cetaceous animals in general, as well as fishes that have been cast ashore. In autumn it sometimes commits great havoc among barley, and in spring occasionally destroys young lambs. It has also been accused of killing diseased sheep by picking out their eyes. It annoys the housewives by sometimes flying off with young poultry, and especially by breaking and sucking, or rather gobbling eggs, which the ducks or hens may have deposited, as they frequently do, among the herbage. In these islands, should a horse or a cow die, as is not unfrequently the case in the beginning of summer, after a severe winter or spring, or should a grampus or other large cetaceous animal be cast on the shore, the ravens speedily assemble, and remain in the neighbourhood until they have devoured it. Whatever may be said by closet-naturalists as to the unrivalled adaptation of the point of the upper mandible of the rapacious birds for tearing flesh, the bill of the raven is in practice quite as efficient an instrument. That bird can not only with great ease tear off morsels of flesh, but can pick the smallest shreds from the bones, and rend the intestines in pieces. When engaged upon a large carcass, they conduct themselves very much in the manner of the North American vultures, as described by Wilson and Audubon. We have seen them thus occupied with a cow. Some were tearing up the flesh from the external parts, others dragging out the intestines, and two or three had made their way into the cavity of the abdomen.

The raven sometimes nestles at no great distance from the eagle, in which case these birds do not molest each other; but in general the former is a determined enemy to the latter, and may often be seen harassing it. Two ravens attack the eagle, one hovering above, the other beneath; but without ever coming into contact with the object of their dislike, which seems to regard them as more disagreeable than dangerous, and appears to hurry on to avoid being pestered by them. Although they keenly pursue all intruders that seem in any way formidable, they on the other hand allow the cormorant, the rock-pigeon, and the black guillemot, to nestle in their immediate vicinity.

The voice of the raven is a hoarse croak, resembling the syllables *croak*, *cruck*, or *chroo*; but it also emits a note not unlike the sound of a sudden gulp, or the syllable *cluck*, which it seems to utter when in a sportive mood; for, although ordinarily grave, the raven sometimes indulges in a frolic, per-

forming somersets and various evolutions in the air, much in the manner of the rook.

The character of this bird accords well with the desolate aspect of the rugged glens of the Hebridian moors. He and the eagle are the fit inhabitants of those grim rocks; the red grouse, the plover, and its page, of those brown and scarred heaths; the ptarmigan of those craggy and tempest-beaten summits. The red-throated diver and merganser, beautiful as they are, fail to give beauty to those pools of dark-brown water, edged with peat banks, and unadorned with sylvan verdure. Even the water-lily, with its splendid white flowers, floating on the deep bog, reflects no glory on the surrounding scenery, but selfishly draws all your regards to itself. This species is also very abundant in the Orkney and Shetland islands. In Sutherland, Ross-shire, and many parts of the county of Inverness, it is also not uncommon. In most of the Highland districts we have met with it here and there. In the lower parts of the middle division of Scotland it is of much rarer occurrence; nor is it plentiful even in the higher and more central portions of the southern division, although we have seen it in many places there. In England it is much less frequently met with than in Scotland, although it seems to be generally distributed there also. If we take the whole range of the island as its residence, we must add to its bill of fare many articles not mentioned above, so as to include young hares and rabbits; other small quadrupeds, as rats, moles, and mice, young poultry, and the young of other birds, as pheasants, grouse, ducks, and geese; eggs of all kinds, echini, mollusca, fruit, barley, wheat, and oats; insects, crustacea, grubs, worms, and probably many other articles, besides fish and carrion of all sorts. In the northern parts of Scotland the raven constructs its nest on high cliffs, especially those on the sea-shore; but in the southern parts of the island, where rocks are not so common as tall trees, it is said frequently to nestle in the latter. According to the locality, it begins to repair its nest, or collect materials for forming a new one, as early as from the beginning to the end of February. In the maritime districts, it is generally composed of twigs of heath, dry sea-weeds, grass, wool, and feathers. It is of irregular construction, and very bulky. The eggs are from four to seven, pale-green, with small spots and blotches of greenish-brown and grey, and are about two inches in length. The young are at first of a blackish colour scantily covered with soft, loose, grayish-black down. They are generally abroad by the middle of May. It has been remarked, that when, during incubation, or even when the young have left the nest, one of the old birds is killed, the survivor soon finds a mate. Ravens, if unmolested, breed in the same spot year after year.

Few birds are possessed of more estimable qualities than the raven. His constitution is such as to enable him to brave the fury of the most violent tempests, and to subsist amidst the most intense cold; he is strong enough to repel any bird of his own size, and his spirit is such as to induce him to attack even the eagle; his affection towards his mate and young is great, although not superior to that manifested by many other birds; in sagacity he is not excelled by any other species; and his power of vision is at least equal to that of most others, not excepting the birds of prey, for he is generally the first to discover a carcass. To man, however, he seems to be more injurious than useful, as he is accused of killing weakly sheep, sometimes destroys lambs, and frequently carries off the young and eggs of domestic poultry. For this reason he is generally proscribed, and in many districts a price is set upon his head; but his instinct and reason suffice to keep his race from materially diminishing. He seems to have fewer feathered enemies than most other birds, for although he may

often be seen pursuing gulls, hawks, and eagles, we have never seen any species attacking him with the exception of the domestic cock. It has been alleged, however, that rooks assail him in defence of their young, and there is nothing incredible in this, for the weakest bird will often in such a case attack the most powerful and rapacious.

The species is very widely distributed over the globe, being more or less common in Europe, Asia, and America; but more abundant towards the arctic regions.

NOTE B.—*The Crow.*

"The crow," says Mr. Wilson in his *'American Ornithology,'* "is perhaps the most generally known, and least beloved, of all our land-birds; having neither melody of song, nor beauty of plumage, nor excellence of flesh, nor civility of manners, to recommend him; on the contrary, he is branded as a thief and a plunderer,—a kind of black-coated vagabond, who hovers over the fields of the industrious, fattening on their labours; and, by his voracity, often blasting their expectations. Hated as he is by the farmer, watched and persecuted by almost every bearer of a gun, who all triumph in his destruction, had not Heaven bestowed on him intelligence and sagacity far beyond common, there is reason to believe that the whole tribe would long ago have ceased to exist.

"It is in the month of May, and until the middle of June, that the crow is most destructive to the corn-fields, digging up the newly planted grains of maize, pulling up by the roots those that have begun to vegetate, and thus frequently obliging the farmer to replant, or lose the benefit of the soil; and this sometimes twice, and even three times, occasioning a considerable additional expense, and inequality of harvest. No mercy is now shown him. The myriads of worms, moles, mice, caterpillars, grubs, and beetles, which he has destroyed, are altogether overlooked on these occasions. Detected in robbing the hens' nests, pulling up the corn, and killing the young chickens, he is considered as an outlaw, and sentenced to destruction. But the great difficulty is, how to put this sentence in execution. In vain the gunner skulks along the hedges and fences; his faithful sentinels, planted on some commanding point, raise the alarm, and disappoint vengeance of its object. The coast again clear, he returns once more in silence to finish the repast he had begun. Sometimes he approaches the farm-house by stealth, in search of young chickens, which he is in the habit of snatching off, when he can elude the vigilance of the mother hen, which often proves too formidable for him. A few days ago, a crow was observed eagerly attempting to seize some young chickens in an orchard, near the room where I write; but these clustering close round the hen, she resolutely defended them, drove the crow into an apple tree, whither she instantly pursued him with such spirit and intrepidity, that he was glad to make a speedy retreat, and abandon his design. The crow himself sometimes falls a prey to the superior strength and rapacity of the great owl, whose weapons of offence are by far the more formidable of the two.

"Towards the close of summer the parent crows, with their new families, forsaking their solitary lodgings, collect together, as if by previous agreement, when evening approaches. About an hour before sunset they are first observed, flying, somewhat in Indian file, in one direction, at a short height above the tops of the trees, silent and steady, keeping the general curvature of the ground, continuing to pass sometimes till after sunset, so that the whole line of march would extend for many miles. This circumstance, so familiar and picturesque, has

not been overlooked by the poets, in their descriptions of a rural evening. Burns, in a single line, has finely sketched it:

"The blackening trains of crows to their repose."

"The most noted crow-roost that I am acquainted with is near Newcastle, on an island in the Delaware. It is there known by the name of the Pea Patch, and is a low flat alluvial spot, of a few acres, elevated but a little above high-water mark, and covered with a thick growth of reeds. This appears to be the grand rendezvous, or head-quarters, of the greater part of the crows within forty or fifty miles of the spot. It is entirely destitute of trees, the crows alighting and nesting among the reeds, which by these means are broken down and matted together. The noise created by those multitudes, both in their evening assembly, and reascension in the morning, and the depredations they commit in the immediate neighbourhood of this great resort, are almost incredible. Whole fields of corn are sometimes laid waste by thousands alighting on it at once, with appetites whetted by the fast of the preceding night; and the utmost vigilance is unavailing to prevent, at least, a partial destruction of this their favourite grain. Like the stragglers of an immense, undisciplined, and rapacious army, they spread themselves over the fields, to plunder and destroy wherever they alight. It is here that the character of the crow is universally execrated; and to say to the man who has lost his crop of corn by these birds, that crows are exceeding useful for destroying vermin, would be as consolatory as to tell him who had just lost his house and furniture by the flames, that fires are excellent for destroying bugs. The strong attachment of the crows to this spot may be illustrated by the following circumstance: Some years ago, a sudden and violent north-east storm came on during the night, and the tide, rising to an uncommon height, inundated the whole island. The darkness of the night, the suddenness and violence of the storm, and the incessant torrents of rain that fell, it is supposed, so intimidated the crows, that they did not attempt to escape, and almost all perished. Thousands of them were next day seen floating in the river; and the wind, shifting to the north-west, drove their dead bodies to the Jersey side, where for miles they blackened the whole shore. This disaster, however, seems long ago to have been repaired; for they now congregate on the Pea Patch in as immense multitudes as ever."

"Individually," says Dr. Godman in the amusing papers which form an appendix to his 'American Natural History,'—"individually, the common crow (*corvus corona*) may be compared in character with the brown or Norway rat, being, like that quadruped, addicted to all sorts of mischief, destroying the lives of any small creatures that may fall in its way, plundering with audacity wherever any thing is exposed to its rapaciousness, and triumphing, by its cunning, over the usual artifices employed for the destruction of ordinary noxious animals. Where food is at any time scarce, or the opportunity for such marauding inviting, there is scarcely a young animal about the farm-yards safe from the attacks of the crow. Young chickens, ducks, goslings, and even little pigs, when quite young and feeble, are carried off by them. They are not less eager to discover the nests of domestic fowls, and will sit very quietly in sight, at a convenient distance, until the hen leaves the nest, and then fly down and suck her eggs at leisure. But none of their tricks excited in me a greater interest than the observation of their attempts to rob a hen of her chicks. The crow, alighting at a little distance from the hen, would advance in an apparently careless way towards the brood, when the vigilant parent would bristle up her feathers, and rush at the black rogue to drive him

off. After several such approaches, the hen would become very angry, and would chase the crow to a greater distance from the brood. This is the very object the robber has in view; for as long as the parent keeps near her young, the crow has very slight chance of success; but as soon as he can induce her to follow him to a little distance from the brood, he takes advantage of his wings, and before she can regain her place, has flown over her, and seized one of her chickens. When the cock is present, there is still less danger from such an attack; for chanticleer shows all his vigilance and gallantry in protecting his tender offspring, though it frequently happens that the number of hens with broods renders it impossible for him to extend his care to all. When the crow tries to carry off a gosling from the mother, it requires more daring and skill, and is far less frequently successful, than in the former instance. If the gander be in company, which he almost uniformly is, the crow has his labour in vain. Notwithstanding the advantages of flight and superior cunning, the honest vigilance and determined bravery of the former are too much for him. His attempts to approach, however cautiously conducted, are promptly met, and all his tricks rendered unavailing, by the fierce movements of the gander, whose powerful blows the crow seems to be well aware might effectually disable him. The first time I witnessed such a scene, I was at the side of a creek, and saw on the opposite shore a goose with her goslings beset by a crow: from the apparent alarm of the mother and brood, it seemed to me they must be in great danger, and I called to the owner of the place, who happened to be in sight, to inform him of their situation. Instead of going to their relief, he shouted back to me, to ask if the gander was not there too; and as soon as he was answered in the affirmative, he bid me be under no uneasiness, as the crow would find his match. Nothing could exceed the cool impudence and pertinacity of the crow, who, perfectly regardless of my shouting, continued to worry the poor gander for an hour, by his efforts to obtain a nice gosling for his next meal. At length, convinced of the fruitlessness of his efforts, he flew off to seek some more easily procurable food. Several crows sometimes unite to plunder the goose of her young, and are then generally successful, because they are able to distract the attention of the parents, and lure them farther from their young.

"In the summer the crows disperse in pairs for the purpose of raising their young, and then they select lofty trees in the remotest parts of the forest, upon which, with dry sticks and twigs, they build a large strong nest, and line it with softer materials. They lay four or five eggs, and when they are hatched, feed, attend, and watch over their young with the most zealous devotion. Should any one by chance pass near the nest while the eggs are still unhatched, or the brood are very young, the parents keep close, and neither by the slightest movement nor noise betray their presence. But if the young are fledged, and beginning to take their first lessons in flying, the approach of a man, especially if armed with a gun, calls forth all their cunning and solicitude. The young are immediately placed in the securest place at hand, where the foliage is thickest, and remain perfectly motionless and quiet. Not so the alarmed parents, both of which fly nearer and nearer to the hunter, uttering the most discordant screams, with an occasional peculiar note, which seems intended to direct or warn their young. So close do they approach, and so clamorous are they as the hunter endeavours to get a good view of them on the tree, that he is almost uniformly persuaded the young crows are also concealed there; but he does not perceive, as he is cautiously trying to get within gunshot, that they are moving from tree to tree, and a

each remove are farther and farther from the place where the young are hid. After continuing this trick until it is impossible that the hunter can retain any idea of the situation of the young ones, the parents cease their distressing outcries, fly quietly to the most convenient lofty tree, and calmly watch the movements of their disturber. Now and then they utter a loud quick cry, which seems intended to bid their offspring lie close and keep quiet; and it is very generally the case that they escape all danger by their obedience. An experienced crow-killer watches eagerly for the tree where the crows first start from; and if this can be observed, he pays no attention to their clamours, nor pretence of throwing themselves in his way, as he is satisfied they are too vigilant to let him get a shot at them; and if he can see the young, he is tolerably sure of them all, because of their inability to fly or change place readily."

A large colony of rooks had subsisted many years in a grove on the banks of the river Irwell, near Manchester. "One serene evening," says Dr. Percival, "I placed myself within the view of it, and marked with attention the various labours, pastimes, and evolutions of this crowded society. The idle members amused themselves with chasing each other through endless mazes; and in their flight they made the air resound with an infinitude of discordant voices. In the midst of these playful exertions it unfortunately happened that one rook struck his beak against the wing of another. The sufferer instantly fell into the river. A general cry of distress ensued; the birds hovered, with every expression of anxiety, over their distressed companion. Animated by their sympathy, and perhaps by the language of counsel known to themselves, he sprang into the air, and, by one strong effort, reached the point of a rock which projected over the water. Their joy became loud and universal; but, alas! it soon changed into notes of lamentation; for the poor wounded bird, in attempting to fly towards his nest, dropped again into the river, and was drowned, amidst the moans of the whole fraternity."

A correspondent of 'the Edinburgh Journal of Natural History' gives the following amusing account of the habits of a rook: "During a severe winter, when the snow had lain long and deep upon the ground, the feathered tribes were reduced to the point of starvation. One morning the Strathendry crows had fixed on some barley, a little to the east of the steading, and had nearly uncovered the stack to get at the grain. To save the barley, one of the men took his gun, and contrived to get within range; but the moment he raised his head, the sentinel on duty sounded the alarm, and the man fired into the dense cloud, as they floated off the stack. Amongst the wounded, one had lost the extremity of his right wing by the joint. Thus disabled, he was soon secured, and given in charge of a servant's wife, who had shown herself an adept in training birds and cats, to try what we could elicit of the innate dispositions and mental faculties of the crow. Daily were this person's birds and cats to be seen feeding, in perfect harmony, from the same dish; and I have frequently seen a cat pretty sharply admonished by a blackbird, when overstepping the bounds of good manners while feeding. No cages were wanted for her birds, though both doors and windows stood open as occasion required. Her feathered and feline family went and came as pleased themselves. If any were absent at feeding-time, she went to the door and called them in Gaelic, as she said she never could make bird or cat obey her in English.

"The first lesson given to the poor mutilated crow was to place him on her knee, while yet starving, with a hand over his shoulders to prevent his stirring, but allowing him full freedom to look down on larks, linnets, blackbirds, and cats, forming a circle

round the feeding-dish. He seemed to eye the cats with suspicion, but 'hunger tames the tiger.' Stretching his neck towards the provisions, and indicating a desire to raise his wings, he was allowed to go down. He shyed at first, walked round them for a time, but at length struck in, and made a hearty meal. From this time he felt quite at home, seemed to study the rules of the house, and kept his place in the crowd, or before the fire, where he often lay quite at his ease, along with the cats, enjoying himself on the warm hearth. It was amusing to see with what familiarity he would stalk about, with all the strut and dignity of a lord-of-the-manoor, mixing inquisitively among the servants, and eyeing all their motions like an attentive superintendent, returning to head-quarters when called, or marching-off to dine with the servants in the bothy. The servants dubbed him 'Captain.' The most remarkable part of his history, however, remains to be told.

"Experience had taught him that his confidence was not misplaced. His gratitude for the protection and ease which he enjoyed was evinced in his filial familiarity and obedience. One day, however, he was observed evidently watching an opportunity to carry-off a piece of boiled potato, which he at last accomplished, and walked with it to the door, as if to hide it, for some future occasion. This he was observed to repeat as often as he found opportunity, as he conceived, unobserved. The circumstance was mentioned to me, and I resolved to watch him out of doors. To prevent detection within, he left the house, and I soon after observed him casting his eyes about him, pause, and then march off towards the bothy,

'Looking round w' canny care,
Lest boggles catch'd him unaware,'

walk cautiously forward, drive his beak into a cold boiled potato, march away in double-quick time, crouching as if afraid of being detected in the act of thieving, and, turning the nearest stack, disappear. Something prevented my following him at the moment, but he soon reappeared for a further supply, took the same route, and again disappeared. I immediately took a cold potato in my hand and followed. On rounding the stack, to my astonishment I found him in the act of feeding another disabled crow. I cautiously neared him. The stranger shyed, lifting his wings to fly off. Captain, however, remained undisturbed. I held out my potato. Captain came with evident satisfaction, took a portion of it from my hand, while the stranger, who halted at a safe distance, was looking on. Captain then walked with the potato towards his friend, who met him, and in the course of feeding I observed, with a painful sensation, that the poor stranger had lost his bill, and consequently was incapable of helping himself, although food had lain before him. What free-masonry passed between them I know not; but on Captain's returning for the remaining portion of my potato, the stranger followed in his rear, with all the familiarity and confident bearing of an old acquaintance. However much my admiration was excited on this first interview with the stranger, I was still more astonished to see him walk side by side with his preserver into the servants' bothy, while the servants were at dinner, without shying, or betraying the least symptom of fear. When they had been fed sumptuously, Captain marched him over to head-quarters, and introduced him to his mistress, cats, and comrades, by whom he was 'most graciously received.' There he remained an inmate, under the title of 'Nebby.' Nebby could fly as well as ever, and took frequent flights round, for intelligence or amusement. I have often seen him on returning alight, and implore his mistress for water, by gently moving his wings and holding up his head. On her sitting down, Nebby was immediately on her knee

to receive it; and it was given him by dipping the finger, and dropping it from the point into his throat. One Sunday, some idle blackguard boys, from some of the mills down the water, carried off both Captain and Nebby. I made every inquiry, but never recovered them."

NOTE C.—*The Rook.*

The husbandman, or farmer, is often unconscious of the good these industrious birds do for him at all seasons, except only in long-continued drought, when the insects descend into the earth, and when its surface becomes so hard as to defy the efforts of the rooks to dig the larvæ out. At such times, indeed, when their natural instincts are neutralized, and when hunger craves, they will in troops fall upon a field of wheat or barley just ripening, and where they will do considerable damage if not scared-off by a sentinel with his racket, or by hanging rags, dipped in melted brimstone, on sticks about the field. But the farmer is unwilling, for this their thievish crime, to agree that they are otherwise serviceable to him, because he can see where the rooks have been at work; single plants of wheat or grass actually pulled out of the ground, which to him appears another unpardonable offence. But if he would examine such depredations closely, he would find that the bird had only pulled up a sickly plant, to reach the grub that was feasting on its roots, and which, but for the rook, would have disrooted many more. The farmer knows well the injury he suffers from the wire-worm, an insect more or less plentiful in every season, especially in old leas when newly broken up. Now, the larvæ of this beetle, together with those of all the chafers, are in the estimation of the rook the sweetest morsels he can meet with, and, led by his keen sense of scent, he will dig them out of the ground though an inch or two below the surface. And as the question concerning the good or bad properties of the rook to the farmers is very differently believed, let any one who has doubts shoot, or have one shot for him, when the bird is on his way home from the feeding ground. Let him open the provision pouch and look at the contents; this he will find consists entirely of the larvæ of insects, which are bred and fed on the roots of plants in the ground. In this great and good service the rook is assisted by the jackdaw and starling, which are almost always seen associated on places where grubs abound.

Mr. Knapp, in his 'Journal of a Naturalist,' has taken a pleasing and favourable view of the rook.—Gesner—he says—"has called the common rook (*Corvus frugilegus*) 'a corn-eating bird.' Linnaeus has somewhat lightened this epithet by considering it only as a gatherer of corn; to neither of which names do I believe it entitled, as it appears to live solely upon grubs, various insects, and worms. It has at times great difficulty to support its life, and in a dry spring or summer most of these are hidden in the earth beyond its reach, except at those uncertain periods when the grub of the chaffer is to be found; and in a hot day we see the poor birds perambulating the fields, and wandering by the sides of the highways, seeking for and feeding upon grasshoppers, or any casual nourishment that may be found. At those times, were it not for its breakfast of dew worms, which it catches in the gray of the morning, as it is appointed the earliest of risers, it would commonly be famished. In the hot summer of 1825, many of the young brood of the season perished from want; the mornings were without dew, and consequently few or no worms were to be obtained; and we found them dead under the trees, having expired on their roostings. It was particularly distressing, for no relief could be given, to hear the constant clamour and importunity of the young for food. The

old birds seemed to suffer without complaint; but the wants of their offspring were expressed by the unceasing cry of hunger, and pursuit of their parents for supply, and our fields were scenes of daily restlessness and lament. Yet, amid all this distress, it was pleasing to observe the perseverance of the old birds in the endeavour to relieve their famishing families, as many of them remained out searching for food quite in the dusk, and returning to their roosts long after the usual period for retiring. In this extremity it becomes a plunderer, to which by inclination it is not much addicted, and resorts to our newly-set potato fields, digging out the cuttings. Ranks are seen sadly defective, the result of its labours, I fear; and the request of my neighbours now and then for a bird from my rookery, to hang up in *terrorem* in their fields, is confirmatory of its bad name. In autumn a ripe pear, or a walnut, becomes an irresistible temptation, and it will occasionally obtain a good share of these fruits. In hard frost it is pinched again, visits for food the banks of streams, and in conjunction with its congener, the 'villain crow,' becomes a wayfaring bird, and 'seeks a dole from every passing steed.'* Its life, however, is not always dark and sombre; it has its periods of festivity also. When the waters retire from meadows and low lands, where they have remained any time, a luxurious banquet is provided for this corvus, in the multitude of worms which it finds drowned on them. But its jubilee is the season of the cock-chaffer (*Melolontha vulgaris*), when every little copse, every oak, becomes animated with it and all its noisy, joyful family feeding and scrambling for the insect food. The power or faculty, be it by the scent, or by other means, that rooks possess of discovering their food, is very remarkable. I have often observed them alight on a pasture of uniform verdure, and exhibiting no sensible appearance of withering or decay, and immediately commence stocking up the ground. Upon investigating the object of their operations, I have found many heads of plantains, the little autumnal dandelions, and other plants, drawn out of the ground and scattered about, their roots having been eaten off by a grub, leaving only a crown of leaves upon the surface. This grub beneath, in the earth, the rooks had detected in their flight, and descended to feed on it, first pulling up the plant which concealed it, and then drawing the larvæ from their holes. By what intimation this bird had discovered its hidden food we are at a loss to conjecture; but the rook has always been supposed to scent matters with great discrimination.

"It is but simple justice to these often-censured birds, to mention the service that they at times perform for us in our pasture lands. There is no plant that I endeavour to root out with more persistency in these places than the turfy hair-grass (*Aira caespitosa*). It abounds in all the colder parts of our grass lands, increasing greatly when undisturbed, and, worthless in itself, overpowers its more valuable neighbours. The larger turfs we pretty well get rid of; but multitudes of small roots are so interwoven with the pasture herbage, that we cannot separate them without injury; and these our persevering rooks stock up for us in such quantities, that in some seasons the fields are strewn with the eradicated plants. The whole so torn up does not exclusively prove to be the hair-grass, but infinitely the larger portion consists of this injurious plant. The object of the bird in performing this service for us,

* During the unusually severe winter of 1829-30, our rooks became certainly 'corn-eaters,' the ground was bound down by the frost, and their favourite food hidden by the snow. They fixed themselves, by dozens, on the oat-ricks out in the fields; and the late sown, just germinating wheat was dug up from the soil to a very injurious extent, by our half-famished birds; but they appeared to return to their common food upon the relenting of the frost.

is to obtain the larvæ of several species of insects, underground feeders, that prey on the roots, as Linnaeus long ago observed upon the subject of the little nard grass (*Nardus stricta*). This benefit is partly a joint operation: the grub eats the root, but not often so effectually as to destroy the plant, which easily roots itself anew: but the rook finishes the affair by pulling it up to get at the larvæ, and thus prevents all vegetation; nor do I believe that the bird ever removes a specimen that has not already been eaten, or commenced upon, by the caterpillar.

"The rook entices its young from the breeding-trees, as soon as they can flutter to any other. These young, for a few evenings after their flight, will return with their parents, and roost where they were bred; but they soon quit their abode, and remain absent the whole of the summer months. As soon, however, as the heat of summer is subdued, and the air of autumn felt, they return and visit their forsaken habitations, and some few of them even commence the repair of their shattered nests; but this meeting is very differently conducted from that in the spring; their voices have now a mellowness approaching to musical, with little admixture of that harsh and noisy contention, so distracting at the former season, and seems more like a grave consultation upon future procedure; and as winter approaches they depart for some other place. The object of this meeting is unknown; nor are we aware that any other bird revisits the nest it has once forsaken. Domestic fowls, indeed, make use again of their old nests; but this is never, or only occasionally, done by birds in a wild state. The daw and rock pigeon will build in society with their separate kindred; and the former even revisits in autumn the places it had nested in. But such situations as these birds require, the ruined castle, abbey, or church tower, ledge in the rock, &c., are not universally found, and are apparently occupied from necessity. The rooks appear to associate from preference to society, as trees are common everywhere; but what motive they can have in view in lingering thus for a few autumnal mornings, and counselling with each other around their abandoned and now useless nests, which before the return of spring are generally beaten from the trees, is by no means manifest to us."

The rook makes a large nest of twigs, lined with wool, hay, and other soft matters, lays four or five spotted eggs, and when the young are half-grown, they leave the nest, and sit to be fed on the branches around; the young are then called *branchers*; and then it is that the gunners have a battue, and a day of slaughter of the helpless young. This cruelty is justified as a means of preventing an over-abundance of those birds; for, notwithstanding all that has been heretofore said in favour of the rooks, there are many farmers who still think they are more injurious than serviceable. In winter, when the frost has hardened the ground, or when it is covered with snow, the poor rooks have a hard struggle to live; they are completely shut out from their natural food, and then they are compelled to be thieves, invading the rick-yards, and striving with the farm-yard poultry for a share of their grain. In such seasons many of the old rooks die of cold and hunger; and then, too, the most vigorous of them have a new propensity—becoming herbivorous or granivorous, rather than insectivorous.

It has been said that farmers in the United States of America suffer much loss of their field crops from the depredations of ground insects; attributing these losses to the circumstance of there being no rooks in that country. So seriously is this circumstance believed, that attempts have been made to introduce the rook into Virginia, but hitherto without success. In Scotland, the rooks are commonly called *craues*, and in Yorkshire they are called *crakes*, and in both

these countries are wrongfully accused of devouring grain at all seasons. Both these provincial names are corruptions of crow, the name of a bird, which, though wearing the same livery, is a being of a very different character.

CHAP. III.

OF THE MAGPIE, AND ITS AFFINITIES.

THERE are such a variety of birds that may be distributed under this head, that we must not expect very precise ideas of any. To have a straight strong bill, legs formed for hopping, a body of about the size of a magpie, and party-coloured plumage, are the only marks by which I must be contented to distinguish this numerous fantastic tribe, that add to the beauty, though not to the harmony, of our landscapes. In fact, their chattering everywhere disturbs the melody of the lesser warblers; and their noisy courtship not a little damps the song of the linnet and the nightingale.

However, we have very few of this kind in our woods compared to those in the neighbourhood of the line. There they not only paint the scene with the beauty and the variety of their plumage, but stun the ear with their vociferation. In those luxurious forests, the singing-birds are scarcely ever heard, but a hundred varieties of the pie, the jay, the roller, the chatterer, and the toucan, are continually in motion, and with their illusive mockeries disturb or divert the spectator, as he happens to be disposed.

The magpie is the chief of this kind with us, and is too well known to need a description. Indeed, were its other accomplishments equal to its beauty, few birds could be put in competition. Its black, its white, its green, and purple, with the rich and gilded combination of the glosses on its tail, are as fine as any that adorn the most beautiful of the feathered tribe. But it has too many of the qualities of a beau to depreciate these natural perfections: vain, restless, loud, and quarrelsome, it is an unwelcome intruder everywhere; and never misses an opportunity, when it finds one, of doing mischief.¹

¹ "I protect the magpie," says Mr. C. Waterton, "with greater care than perhaps any other bird, on account of its having nobody to stand up for it. Both rich and poor seem to entertain so great an antipathy to this gay and lively bird in its wild state, that I often wonder how the breed has managed to escape utter extirpation in this populous district. The country gentlemen all agree in signing the death-warrant of this friendless bird, because it is known to suck eggs, and to strangle young game; whilst, in general, the lower orders have an insurmountable prejudice against it, on the score of its supposed knowledge of their future destiny. They tell you that, when four of these ominous birds are seen together, it is a sure sign that, ere long, there will be a funeral in the village; and that nine are quite a horrible sight. I have often heard countrymen say

The magpie bears a great resemblance to the butcher-bird in its bill, which has a sharp process near the end of the upper chap, as well as in the shortness of its wings, and the form of the tail; each feather shortening from the two middlemost. But it agrees still more in its food, living not only upon worms and insects, but also upon small birds when they can be seized. A wounded lark, or a young chicken separated from the hen, are sure plunder; and the magpie will even sometimes set upon and strike a blackbird.

The same insolence prompts it to tease the largest animals, when its insults can be offered with security. They often are seen perched upon the back of an ox or a sheep, pecking up the insects to be found there, chattering, and tormenting the poor animal at the same time, and stretching out their necks for combat if the beast turns its head backward to reprehend them.² They seek out also the nests of birds; and, if the parent escapes, the eggs make up for the deficiency: the thrush and the blackbird are but too frequently robbed by this assassin, and this, in some measure, causes their scarcity.

No food seems to come amiss to this bird; it shares with ravens in their carrion, with rooks in their grain, and with the cuckoo in birds' eggs: but it seems possessed of a providence seldom usual with gluttons; for when it is satisfied for the present, it lays up the remainder of the feast for another occasion. It will even in a tame state hide its food when it has done eating, and after a time return to the secret hoard with renewed appetite and vociferation.

In all its habits it discovers a degree of instinct unusual to other birds. Its nest is not less remarkable for the manner in which it is composed, than for the place the magpie takes to build

that they had rather see any bird than a magpie; but, upon my asking them the cause of their antipathy to the bird, all the answer that I could get was, that they knew it to be unlucky, and that it always contrived to know what was going to take place. I am fully aware that it has propensities of a sufficiently predatory nature to bring it into general disrepute with civilized man; but let us remember that, like the carrion crow, it only exercises them to any serious extent for about two months in the spring of the year. At that season, it certainly commences operations with surprising assiduity. Cacus himself, that ancient thief, when he was about to steal the cows of Hercules, never exhibited greater cunning than that which this bird puts in practice after it has discovered a hen's nest in the yard, or a place of sitting game in the field. Both the magpie and the carrion crow transfix the eggs with their beaks, and then convey them through the air. After the season of incubation is over, the magpie becomes a harmless bird (unless the pilfering of a little unprotected fruit be considered a crime), and spends the remainder of the year in works of great utility to man, by destroying millions of insects, and by preventing the air from being infected with the noxious effluvia arising from the scourgings of slaughter-houses."—ED.

² Goldsmith was evidently not aware that, in these visits, the magpie is rendering a friendly service to the cattle by freeing them from vermin.—ED.

it in. The nest is usually placed conspicuous enough, either in the middle of some hawthorn-bush, or on the top of some high tree. The place, however, is always found difficult of access; for the tree pitched upon usually grows in some thick hedge-row fenced by brambles at the root; or sometimes one of the higher bushes is fixed upon for the purpose.³ When the place is thus chosen as inaccessible as possible to men, the next care is to fence the nest above so as to defend it from all the various enemies of air. The kite, the crow, and the sparrow-hawk, are to be guarded against; as their nests have been sometimes plundered by the magpie, so it is reasonably feared that they will take the first opportunity to retaliate. To prevent this, the magpie's nest is built with surprising labour and ingenuity.⁴

³ There is considerable discrepancy in the accounts given by naturalists of the haunts of the magpie. "The tall tangled hedge-row," says Mr. Knapp, "the fir grove, or the old well-wooded enclosure constitutes its delight, as there alone its large dark nest has any chance of escaping observation." It "always," says Jennings, "builds a solitary nest either in a thorn-bush or on some lofty elm, and sometimes on an apple-tree: it does not often build very near dwelling-houses, but a remarkable exception to this has lately occurred in Somersetshire, at Huntspill, a magpie not only having built its nest on a tree a very short distance from a dwelling-house, but it occupied the same nest two years successively." Wilson, on the other hand, speaking, we apprehend, of its habits in Scotland as well as in America, says it "generally selects a tall tree adjoining the farm-house for its nest, which is placed amongst the highest branches." Another writer says "it nestles in the tall hedge, or in a thick tree near the cottage:" "it is no bird of the wilderness." This agrees with our own observations; for we have remarked the magpie to be no less partial to human neighbourhood than its congener the rook, and, so far from sequestering itself, though it is certainly a shy and wary bird, we have seldom met with it except near farm-houses. In the north, almost every farm has its denizen pair of magpies, which incubate in their hereditary nest on the old ash tree year after year, precisely like an hereditary colony of rooks. In the more closely-wooded districts of the south, indeed, it does not so frequently build on the trees in the farm-yard; yet we observed, in 1830, a magpie's nest in such a locality on the borders of Epping-forest, near Chigwell, and another in a clump of elms about a hundred yards from Sion House, the seat of the duke of Northumberland. Waterton says the magpie builds its nest in any tree, and in any situation.—ED.

⁴ "Amongst our larger birds," says Mr. Rennie on the 'Architecture of Birds,' "the magpie excels all her congeners in architectural skill. Several of the older naturalists were inclined to attribute to her more ingenuity than facts will corroborate. Albertus Magnus, for example, says she not only constructs two passages for her nest, one for entering and another for going out, but frequently makes two nests on contiguous trees, with the design of misleading plunderers, who may as readily choose the empty nest as the one containing the eggs, on the same principle that Dionysius the tyrant had thirty sleeping-rooms. Others maintain that the opening opposite the passage is for the tail of the mother-magpie when hatching. Before speculating upon the use of this, it would have been well to ascertain its existence; for among the numerous magpies' nests

The body of the nest is composed of hawthorn branches, the thorns sticking outward, but well united together by their mutual insertions. Within it is lined with fibrous roots, wool, and long grass, and then nicely plastered all round with mud and clay. The body of the nest being thus made firm and commodious, the next work is to make the canopy which is to defend it above. This is composed of the sharpest thorns, wove together in such a manner as to deny all entrance except at the door, which is just large enough to permit egress and regress to the owners. In this fortress the male and female hatch and bring up their brood with security, sheltered from all attacks but those of the climbing schoolboy, who often finds his torn and bloody hands too dear a price for the eggs or the young ones. The magpie lays six or seven eggs, of a pale green colour, spotted with brown.

This bird, in its domestic state, preserves its natural character with strict propriety. The same noisy mischievous habits attend it to the cage that marked it in the woods; and being more cunning, so it is also a more docile bird than any other taken into keeping.⁵ Those who

which we have seen (two very perfect ones are now before us) the alleged second opening is by no means apparent, though in some instances the twigs may appear more loosely woven than in others, but seldom so much so, we think, as to permit a passage to the bird."—ED.

⁵ A bell-founder, in the parish of Saint Jean en Greve, at Paris, having lost from time to time several silver spoons, and other articles of value, at length suspected his servant-maid to be the thief; and in order to satisfy himself, and to detect her, if possible, he laid a couple of silver trinkets in an apartment to which himself, his wife, and the said servant, were the only persons who had access. On the following day the trinkets were missing, and suspicion of course fell on the maid. The master questioned her, as to her having been in the room; the girl hesitated for some moments, and then in a faltering tone of voice, said she remembered to have opened the door of that room to admit the air, but had seen nothing of the things lost. This reply seemed to confirm her master more in his opinion of her guilt; he accordingly had her taken up on suspicion, and she was fully committed for trial. After the usual ceremonies of the trial, in which the passions and prejudices of the judges and accusers but too frequently usurp the seat of impartial investigation, she was found guilty of the alleged crime, and suffered death accordingly. Some time afterwards, the bell-founder was sent for to arrange and repair the church bells; and on entering the steeple, to examine the same, he was much surprised to find a favourite magpie he had kept about his house, perched up near the church clock. Struck with the appearance of his old inmate in so uncommon a place, he could hardly believe it to be the same; to satisfy himself, he therefore called the bird by its name, 'Mag! Mag!' The bird then hopped a few paces towards the man, stopped suddenly, ruffled up his plumage, chattered in his way, and then fled away to a hole in the roof. Curiosity led the man to follow it; but what words can express his astonishment and confusion, when he beheld deposited in a corner of the hole, the very identical articles for which the poor unfortunate girl lost her life, with several others

are desirous of teaching it to speak have a foolish custom of cutting its tongue, which only puts the poor animal to pain, without improving its speech in the smallest degree. Its speaking is sometimes very distinct; but its sounds are too thin and sharp to be an exact imitation of the human voice, which the hoarse raven and parrot can counterfeit more exactly.

To this tribe we may refer the jay, which is one of the most beautiful of the British birds. The forehead is white, streaked with black; the head is covered with very long feathers, which it can erect into a crest at pleasure; the whole neck, back, breast, and belly, are of a faint purple, dashed with gray; the wings are most beautifully barred with a lovely blue, black, and white; the tail is black, and the feet of a pale brown. Like the magpie, it feeds upon fruits, will kill small birds, and is extremely docile.⁶

The chatterer also, which is a native of Germany, may be placed in this rank; and is somewhat less than the former. It is variegated with a beautiful mixture of colours; red, ash-colour, chestnut, and yellow; but what distinguishes it from all other birds, are the horny appendages from the tips of seven of the lesser quill feathers, which stand bare of beards, and have the colour and gloss of the best red sealing-wax.

The roller is not less beautiful than any of the former. The breast and belly are blue; the head green; and the wings variegated with blue, black, and white. But it may be distinguished from all others by a sort of naked tubercles or warts near the eyes, which still farther contribute to increase its beauty.

To this class may be added a numerous list from all the tropical forests of the east and west; where the birds are remarkable for discordant voices and brilliant plumage. I will fix only upon one, which is the most singular of all the feathered creation. This is the toucan, a bird of

he had missed at different times. The whole of this extraordinary affair was soon publicly known. The people, in a paroxysm of enthusiastic zeal, threatened vengeance on the girl's accusers and judges; and to prevent those serious consequences so much apprehended, it was found necessary to appease the multitude, by an order that mass should be said, and a solemn *Domine exaudivit* offered up, for the peace of her soul, in the church of St. Jean en Greve; where this tragedy is recorded, and where the virgins of the surrounding neighbourhood repair annually at midnight, dressed in robes of the whitest lawn, and bearing each a branch of cypress, to sing a requiem, and to implore the divine protection for the innocent sufferer. This ceremony is still commemorated, and is called 'the Mass of the Magpie.' A popular drama, called 'The Maid and Magpie,' is founded on this incident.

In most countries the magpie is esteemed a bird of omen. In various parts of Scotland and the north of England, if one of these birds is observed flying by itself, it is accounted by the vulgar a sign of ill luck; if there are two together, they forebode something fortunate; three indicate a funeral, and four a wedding.—ED.

⁶ See Supplementary Note, p. 92.

the pie kind, whose bill is nearly as large as the rest of its whole body.

Of this extraordinary bird there are four or five varieties. I will only describe the red-beaked toucan; and as the figure of this bird makes the principal part of its history, I will follow Edwards through all the minutiae of its singular conformation. It is about the size of and shaped like a jackdaw, with a large head to support its monstrous bill; this bill, from the angles of the mouth to its point, is six inches and a half; and its breadth, in the thickest part, is a little more than two. Its thickness near the head is one inch and a quarter; and it is a little rounded along the top of the upper chap, the under side being round also; the whole of the bill is extremely slight, and a little thicker than parchment. The upper chap is of a bright yellow, except on each side, which is of a fine scarlet colour; as is also the lower chap, except at the base, which is purple. Between the head and the bill there is a black line of separation all round the base of the bill; in the upper part of which the nostrils are placed, and are almost covered with feathers; which has occasioned some writers to say, that the toucan has no nostrils. Round the eyes, on each side of the head, is a space of bluish skin, void of feathers, above which the head is black, except a white spot on each side joining to the base of the upper chap. The hinder part of the neck, the back, wings, tail, belly, and thighs, are black. The under side of the head, throat, and the beginning of the breast, are white. Between the white on the breast and the black on the belly is a space of red feathers, in the form of a new moon, with its horns upwards. The legs, feet, and claws, are of an ash-colour; and the toes stand like those of the parrot, two before and two behind.

It is reported by travellers, that this bird, though furnished with so formidable a beak, is harmless and gentle, being so easily made tame as to sit and hatch its young in houses.⁷ It feeds

chiefly upon pepper, which it devours very greedily, gorging itself in such a manner that it voids it crude and unconcocted. This, however, is no objection to the natives from using it again; they even prefer it before that pepper which is fresh gathered from the tree; and seem persuaded that the strength and heat of the pepper are qualified by the bird, and that all its noxious qualities are thus exhausted.

Whatever be the truth of this report, nothing is more certain than that the toucan lives only upon a vegetable diet; and in a domestic state, to which it is frequently brought in the warm countries where it is bred, it is seen to prefer such food to all other. Pozzo, who bred one tame, asserts, that it leaped up and down, wagged the tail, and cried with a voice resembling that of a magpie. It fed upon the same things that parrots do; but was most greedy of grapes, which, being plucked off one by one, and thrown into the air, it would most dexterously catch before they fell to the ground. Its bill, he adds, was hollow, and upon that account very light, so that it had but little strength in so apparently formidable a weapon; nor could it peck or strike smartly therewith. But its tongue seemed to assist the efforts of this unwieldy machine; it was long, thin, and flat, not unlike one of the feathers on the neck of a dunhill-cock; this it moved up and down, and often extended five or six inches from the bill. It was of a flesh colour, and very remarkably fringed on each side with very small filaments, exactly resembling a feather.

It is probable that this long tongue has greater strength than the thin hollow beak that contains it. It is likely that the beak is only a kind of sheath for this peculiar instrument, used by the toucan, not only in making itself a nest, but also in obtaining its provision. Nothing is more certain, than that this bird builds its nest in holes of trees, which have been previously scooped out for this purpose; and it is not very likely that so feeble a bill could be very serviceable in working upon such hard materials.

Be this as it will, there is no bird secures its young better from external injury than the toucan. It has not only birds, men, and serpents, to guard against, but a numerous tribe of monkeys, still more prying, mischievous, and hungry, than all the rest. The toucan, however, scoops out its nest in the hollow of some tree, leaving only a hole large enough to go in and out at. There it sits, with its great beak, guarding the entrance, and if the monkey venture to offer a visit of curiosity, the toucan gives him such a welcome, that he presently thinks proper to pack off, and is glad to escape with safety.

This bird is only found in the warm climates

⁷ The toucans, according to M. D'Azara, destroy a great number of birds, their large bill rendering them formidable to most species. They attack them in their nests, and devour their eggs and young ones. "The toucan," says Mr. Rennie, "is omnivorous, feeding (like the magpie) on young birds and eggs, and on fruits. For the former purpose the bill is admirably adapted, enabling it to delve into the deep and narrow nests of the South American birds, while the delicacy of the nerves enables it, like the snipe, to search out its prey. The bill is equally well fitted for feeding on soft tropical fruits. A living specimen of this bird, kept for seven years in the possession of Mr. Vigors, afforded full opportunity of ascertaining the correctness of these statements." The monkeys and the toucan are perpetually at war with each other. They often assail him in his nest, that they may dislodge him for the sake of the contents. They do not pretend to make capture of an old bird, being too well acquainted with the formidable power of its bill. These rencontres are very amusing to a spectator, exhibiting as they do, cunning and artifice opposed to honest courage and indomitable strength.

Cases occur, however, in which the monkey's ingenuity enables him to gain his point, and laugh in his own way at his dupe.—ED.

of South America, where it is in great request, both for the delicacy of its flesh, which is tender and nourishing, and for the beauty of its plumage, particularly the feathers of the breast. The skin of this part the Indians pluck off, and, when dry, glue to their cheeks; and this they consider as an irresistible addition to their beauty.

SUPPLEMENTARY NOTE.—*The Jay family.*

The jays constitute a genus of birds very nearly allied to the crows, from which they differ chiefly in having the bill less strong, the tail more elongated, their colours more gaudy, and their habits approximating to those of the titmice, to which also they are nearly allied. They reside chiefly in woods and thickets, occasionally betaking themselves to the open country in the neighbourhood, and feed on fruits, seeds, insects, worms, sometimes eggs and young of other birds, as well as small quadrupeds, and carrion. They are, in short, as omnivorous as the crows. They are generally dispersed, and some of the species are spread over a vast extent of country.

The jays differ from the pies principally in the bill, which is more hooked, and in having some long loose feathers on the crown of the head, which are erected when the birds are excited; the tail, moreover, in these birds, is longer and more graduated. They may almost be said to be omnivorous, living in general in the woods, but occasionally resorting to gardens and cultivated lands, to both of which they are injurious and destructive, as well by what they eat at the time, as by what they carry off to increase their hidden stores. In summer they live in pairs, but in the opposite season assemble in small groups. They advance on the ground always by leaps, and seldom or never walk. In disposition they are very irascible, petulant, and inquisitive, and take their scientific generic name, *garrulus*, from their constant loquacity. The nest is built in trees, generally at about half-way from the bottom, of sticks, interlaced together on the outside, cased within with mud, and lined with dry grass and fibres: the entrance to it is at the side. The eggs are white, spotted with brown and gray, and are from six to eight in number. The common jay does not seem to be very generally or exclusively located, and is partially migratory from the west and northern parts of Europe to the south-east, as the islands of the Grecian Archipelago, and also Egypt, Syria, &c. Though many are thus said to migrate, it is nevertheless clear that some continue in our own country and in France the whole year.

The *Florida jay* (*G. Floridanus*), although a native of Florida, as its name implies, occurs also in Louisiana, Kentucky, and other parts of the United States.

Steller's jay (*G. Stelleri*) is peculiar to the north-western coast of America, and was first described by Latham from a specimen obtained, on Cook's Expedition, at Nootka-sound.

The *Canadian jay* (*G. Canadensis*) inhabits the northern parts of the United States, and the British settlements in North America.

The *red-billed jay* is a very splendid bird. The bill and feet are red; the neck and breast are black; the crown of the head dotted black and white; body, above and beneath, ashen; of the tail-feathers, the two intermediate are much the longest, and the lateral feathers are graduated; they are blue, tipped with white, and a black bar between that colour and the blue. Inhabits China, and is frequently rendered very tame and amusing.

Of the *blue jay*, an inhabitant of North America,

Wilson has given the following interesting account. "The blue jay is an almost universal inhabitant of the woods, frequenting the thickest settlements as well as the deepest recesses of the forest, where his squalling voice often alarms the deer, to the disappointment and mortification of the hunter,—one of whom informed me that he made it a point, in summer, to kill every jay he could meet with. In the charming season of spring, when every thicket pours forth harmony, the part performed by the jay always catches the ear. He appears to be among his fellow-musicians what the trumpeter is in a band, some of his notes having no distant resemblance to the tones of that instrument. These he has the faculty of changing through a great variety of modulations, according to the particular humour he happens to be in. When disposed for ridicule, there is scarce a bird whose peculiarities of song he cannot tune his notes to. When engaged in the blandishments of love, they resemble the soft chatterings of a duck, and, while he nestles among the thick branches of the cedar, are scarce heard at a few paces distance: but he no sooner discovers your approach than he sets up a vehement outcry, flying off, and screaming with all his might, as if he called the whole feathered tribe of the neighbourhood to witness some outrageous usage he had received. When he hops undisturbed among the high branches of the oak and hickory, they become soft and musical; and his calls for the female a stranger would mistake for the repeated squeakings of an ungreased wheel-barrow. All these he accompanies with various nods, and jerks, and other gesticulations, for which the whole tribe of jays are so remarkable, that, with some other peculiarities, they might have very well justified the great Swedish naturalist in forming them into a separate genus by themselves.

"The blue jay builds a large nest, frequently in the cedar, sometimes on an apple-tree, lines it with dry fibrous roots, and lays five eggs of a dull olive, spotted with brown. The male is particularly careful of not being heard near the place, making his visits as silently and secretly as possible. His favourite food is chestnuts, acorns, and Indian corn. He occasionally feeds on bugs and caterpillars, and sometimes pays a plundering visit to the orchard, cherry rows, and potato patch; and has been known, in times of scarcity, to venture into the barn, through openings between the weather boards. In these cases he is extremely active and silent, and, if surprised in the fact, makes his escape with precipitation, but without noise, as if conscious of his criminality.

"Of all birds he is the most bitter enemy to the owl. No sooner has he discovered the retreat of one of these, than he summons the whole feathered fraternity to his assistance, who surround the glimmering *solitaire*, and attack him from all sides, raising such a shout as may be heard, in a still day, more than half-a-mile off. When, in my hunting excursions, I have passed near this scene of tumult, I have imagined to myself that I heard the insulting party venting their respective charges with all the virulence of a Billingsgate mob; the owl, meanwhile, returning every compliment with a broad oggling stare. The war becomes louder and louder, and the owl at length, forced to betake himself to flight, is followed by his whole train of persecutors, until driven beyond the boundaries of their jurisdiction.

"But the blue jay himself is not guiltless of similar depredations with the owl, and becomes in his turn the very tyrant he detested, when he sneaks through the woods, as he frequently does, and among the thickets and hedge-rows, plundering every nest he can find of its eggs, tearing up the callow young by piecemeal, and spreading alarm and sorrow around him. The cries of the distressed parents soon bring

together a number of interested spectators (for birds in such circumstances seem truly to sympathize with each other), and he is sometimes attacked with such spirit as to be under the necessity of making a speedy retreat.

"He will sometimes assault small birds, with the intention of killing and devouring them: an instance of which I myself once witnessed, over a piece of woods near the borders of Schuylkill; where I saw him engaged for more than five minutes pursuing what I took to be a species of motacilla (*m. maculosa*, yellow rump), wheeling, darting, and doubling in the air, and, at last, to my great satisfaction, got disappointed in the escape of his intended prey. In times of great extremity, when his hoard or magazine is frozen up, buried in snow, or perhaps exhausted, he becomes very voracious, and will make a meal of whatever carrion or other animal substance comes in the way, and has been found regaling himself on the bowels of a robin (*Turdus migratorius*) in less than five minutes after it was shot.

"There are, however, individual exceptions to this general character for plunder and outrage, a proneness for which is probably often occasioned by the wants and irritations of necessity. A blue jay, which I have kept for some time, and with which I am on terms of familiarity, is in reality a very notable example of mildness of disposition and sociability of manners. An accident in the woods first put me in possession of this bird, while in full plumage, and in high health and spirits: I carried him home with me, and put him into a cage already occupied by a golden-winged woodpecker (*Picus auratus*), where he was saluted with such rudeness, and received such a drubbing from the lord of the manor, for entering his premises, that, to save his life, I was obliged to take him out again. I then put him into another cage, where the only tenant was a female (*Oriolus spurius*). She also put on airs of alarm, as if she considered herself endangered and insulted by the intrusion; the jay, meanwhile, sat mute and motionless on the bottom of the cage, either dubious of his own situation, or willing to allow time for the fears of his neighbour to subside. Accordingly, in a few minutes, after displaying various threatening gestures (like some of those Indians we read of in their first interviews with the whites), she began to make her approaches, but with great circumspection, and readiness for retreat. Seeing, however, the jay begin to pick up some crumbs of broken chestnuts, in an humble and peaceable way, she also descended, and began to do the same; but, at the slightest motion of her new guest, wheeled round, and put herself on the defensive. All this ceremonious jealousy vanished before evening; and they now roost together, feed, and play together, in perfect harmony and good humour. When the jay goes to drink, his messmate very impudently jumps into the saucer to wash herself, throwing the water in showers over her companion, who bears it all patiently; venturing now and then to take a sip between every splash, without betraying the smallest token of irritation. On the contrary, he seems to take pleasure in his little fellow-prisoner, allowing her to peck (which she does very gently) about his whiskers, and to clean his claws from the minute fragments of chestnuts which happen to adhere to them. This attachment on the one part, and mild condescension on the other, may perhaps partly be the effect of mutual misfortunes, which are found not only to knit mankind, but many species of inferior animals, more closely together: and shows that the disposition of the blue jay may be humanized, and rendered susceptible of affectionate impressions, even for those birds which, in a state of nature, he would have no hesitation in making a meal of. He is not only bold and vociferous, but possesses a considerable talent for mimicry, and seems to enjoy great

satisfaction in mocking and teasing other birds, particularly the little hawk (*f. Sparverius*), imitating his cry wherever he sees him, and squealing out as if caught: this soon brings a number of his own tribe around him, who all join in the frolic, darting about the hawk, and feigning the cries of a bird sorely wounded, and already under the clutches of its devourer; while others lie concealed in bushes, ready to second their associates in the attack. But this ludicrous farce often terminates tragically. The hawk, singling out one of the most insolent and provoking, sweeps upon him in the unguarded moment, and offers him up a sacrifice to his hunger and resentment. In an instant the tune is changed; all their buffoonery vanishes, and loud and incessant screams proclaim their disaster."

CHAP. IV.

OF THE WOODPECKER, AND ITS AFFINITIES.

WE now come to the numerous tribe of woodpeckers: a class easily distinguishable from all others, both for their peculiar formation, their method of procuring food, and their manner of providing a place of safety for their young. Indeed, no other class of birds seems more immediately formed for the method of life they pursue, being fitted by nature, at all points, for the peculiarity of their condition. They live chiefly upon the insects contained in the body of trees; and for this purpose are furnished with a straight, hard, strong, angular, and sharp bill, made for piercing and boring. They have a tongue of a very great length; round, ending in a sharp, stiff, bony thorn, dentated on each side, to strike ants and insects when dislodged from their cells. Their legs are short and strong, for the purposes of climbing. Their toes stand two forward and two backward; which is particularly serviceable in holding by the branches of the trees. They have hard stiff tails to lean upon when climbing. They feed only upon insects, and want that intestine which anatomists call the *cæcum*; a circumstance peculiar to this tribe only.

Of this bird there are many kinds, and many varieties in each kind. They form large colonies in the forests of every part of the world. They differ in size, colour, and appearance; and agree only in the marks above-mentioned, or in those habits which result from so peculiar a conformation. Instead, therefore, of descending into a minute discrimination of every species, let us take one for a pattern, to which all the rest will be found to bear the strongest affinity. Words can but feebly describe the plumage of a bird; but it is the province of history to enter into a detail of every animal's pursuits and occupations.

The Green woodspite, or woodpecker, is called the *rainfowl* in some parts of the country; because, when it makes a greater noise than ordinary, it is supposed to foretell rain. It is about the size of a jay; the throat, breast, and belly

are of a pale greenish colour; and the back, neck, and covert feathers of the wings, are green. But the tongue of this little animal makes its most distinguished characteristic, as it serves for its support and defence. As was said above, the woodpecker feeds upon insects; and particularly on those which are lodged in the body of hollow or of rotting trees. The tongue is its instrument for killing and procuring this food; which cannot be found in great plenty. This is round, ending in a stiff, sharp, bony tip, dentated on both sides, like the beard of an arrow; and this it can dart out three or four inches from the bill, and draw in again at pleasure. Its prey is thus transfixed, and drawn into the bill, which, when swallowed, the dart is again launched at fresh game. Nothing has employed the attention of the curious in this part of anatomy, more than the contrivance by which the tongue of this bird performs its functions with such great celerity. The tongue is drawn back into the bill by the help of two small round cartilages, fastened into the forementioned bony tip, and running along the length of the tongue. These cartilages, from the root of the tongue, take a circuit beyond the ears; and being reflected backwards to the crown of the head, make a large bow. The muscular spongy flesh of the tongue encloses these cartilages like a sheath; and is so made that it may be extended or contracted like a worm. The cartilages indeed have muscles accompanying them along their whole length backwards.—But there is still another contrivance; for there is a broad muscle joining the cartilages to the bones of the skull, which, by contracting or dilating, forces the cartilages forward through the tongue, and then forces the tongue and all through the bill, to be employed for the animal's preservation in piercing its prey.¹

Such is the instrument with which this bird is provided; and this the manner in which this instrument is employed. When a woodpecker, by its natural sagacity, finds out a rotten hollow tree, where there are worms, ants' eggs, or insects, it immediately prepares for its operations. Resting by its strong claws, and leaning on the thick feathers of its tail, it begins to bore with its sharp strong beak, until it discloses the whole internal habitation. Upon this, either through pleasure at the sight of its prey, or with a desire to alarm the insect colony, it sends forth a loud cry, which throws terror and confusion into the whole insect tribe. They creep hither and thither, seeking for safety; while the bird luxuriously feasts upon them at leisure, darting its tongue with unerring certainty, and devouring the whole brood.

The woodpecker, however, does not confine its depredations wholly to trees, but sometimes lights upon the ground, to try its fortune at an ant-hill. It is not so secure of prey there as in

the former case, although the numbers are much greater. They lie generally too deep for the bird to come at them; and it is obliged to make up by stratagem the defect of power. The woodpecker first goes to their hills, which it pecks, in order to call them abroad; it then thrusts out its long red tongue, which being like a worm, and resembling their usual prey, the ants come out to settle upon in great numbers; however, the bird watching the properest opportunity, withdraws its tongue at a jerk, and devours the devourers. This stratagem it continues till it has alarmed their fears, or till it is quite satisfied.²

As the woodpecker is obliged to make holes in trees to procure food, so is it also to make cavities still larger to form its nest, and to lay in. This is performed, as usual, with the bill; although some have affirmed that the animal uses its tongue as a gimlet to bore with. But this is a mistake; and those that are curious may often hear the noise of the bill making its way in large woods and forests. The woodpecker chooses, however, for this purpose, trees that are decayed, or wood that is soft, like beech, elm, and poplar. In these, with very little trouble, it can make holes as exactly round as a mathematician could with compasses. One of these holes the bird generally chooses for its own use, to nestle and bring up its young in; but as they are easily made, it is delicate in its choice, and often makes twenty before one is found fit to give entire satisfaction. Of those which it has made and deserted, other birds, not so good borers, and less delicate in their choice, take possession. The jay and the starling lay their eggs in these holes, and bats are now and then found in peaceable possession. Boys sometimes have thrust in their hand with certain hopes of plucking out a bird's egg; but to their great mortification, have had their fingers bitten by a bat at the bottom.

The woodpecker takes no care to line its nest with feathers or straw; its eggs are deposited in the hole, without anything to keep them warm, except the heat of the parent's body. Their number is generally five or six; always white, oblong, and of a middle size. When the young are excluded, and before they leave the nest, they are adorned with a scarlet plumage under the throat, which adds to their beauty.³

In our climate, this bird is contented with such a wainscot habitation as has been described for its young; but in the warmer regions of Guinea and Brazil they take a very different method to

² The *wryneck*, so called from a habit of turning the neck, bears a close analogy to the woodpeckers, in the extensibility of the tongue, and the position of the toes. This bird darts its long tongue into an ant-hill, and draws it out loaded with ants, which are retained by the viscous liquid which covers it.

—Ed.

³ See Supplementary Note A, p. 95.

¹ See Supplementary Note B, p. 99.

protect and hatch their nascent progeny. A traveller who walks into the forests of those countries, among the first objects that excite curiosity, is struck with the multitude of birds' nests hanging at the extremity of almost every branch. Many other kinds of birds build in this manner, but the chief of them are of the woodpecker kind; and indeed there is not, in the whole history of nature, a more singular instance of the sagacity of these little animals in protecting themselves against such enemies as they have most occasion to fear. In cultivated countries, a great part of the caution of the feathered tribe is to hide or defend their nests from the invasions of man: as he is their most dreaded enemy. But in the depth of those remote and solitary forests, where man is but seldom seen, the little bird has nothing to apprehend from man. The parent is careless how much the nest is exposed to general notice; satisfied if it be out of the reach of those rapacious creatures that live by robbery and surprise. If the monkey or the snake can be guarded against, the bird has no other enemies to fear; for this purpose its nest is built upon the depending points of the most outward branches of a tall tree, such as the banana or the plantain. On one of those immense trees is seen the most various and the most inimical assemblage of creatures that can be imagined. The top is inhabited by monkeys of some particular tribe, that drive off all others; lower down twine about the great trunk numbers of the larger snakes, patiently waiting till some unwary animal comes within the sphere of their activity, and at the edges of the tree hang these artificial nests, in great abundance, inhabited by birds of the most delightful plumage.

The nest is usually formed in this manner: When the time of incubation approaches, they fly busily about, in quest of a kind of moss, called by the English inhabitants of those countries, *old man's beard*. It is a fibrous substance, and not very unlike hair, which bears being moulded into any form, and suffers being glued together. This therefore the little woodpecker, called by the natives of Brazil, the *guiratemga*, first glues, by some viscous substance gathered in the forest, to the extremest branch of a tree; then building downward, and still adding fresh materials to those already procured, a nest is formed, that depends, like a pouch, from the point of the branch: the hole to enter at is on the side; and all the interior parts are lined with the finer fibres of the same substance, which compose the whole.

Such is the general contrivance of these hanging nests; which are made by some other birds with still superior art. A little bird of the Grosbeak kind, in the Philippine islands, makes its nest in such a manner that there is no opening but from the bottom. At the bottom the bird enters, and goes up through a funnel like a chimney, till it comes to the real door of the nest,

which lies on one side, and only opens into this funnel.⁴

Some birds glue their nest to the leaf of the banana-tree, which makes two sides of their little habitation; while the other two are artificially composed by their own industry. But these, and all of the kind, are built with the same precautions to guard the young against the depredations of monkeys and serpents, which abound in every tree. The nest hangs there before the spoilers, a tempting object, which they can only gaze upon, while the bird flies in and out, without danger or molestation from so formidable a vicinity.

⁴ This bird constructs a curious nest with the long fibres of plants and grass, and suspends it by a kind of cord, nearly half an ell long, from the end of a slender branch of a tree, that it may be inaccessible to snakes, and secure from the intrusion of the numerous monkeys which inhabit those regions. At the end of this cord is a gourd-shaped nest, divided into three apartments; the first of which is occupied by the male, the second by the female, and the third contains the young; and in the first apartment, where the male keeps watch, is placed on one side a little tough clay, and on the top of this clay is fixed a glow-worm, to afford its inhabitants light in the night.—See Supplementary Note C, p. 100.—Ed.

NOTE A.—The Woodpecker.

Wilson, in his 'American Ornithology,' is particularly lively in his description of the various woodpeckers of America. Of the ivory-billed woodpecker he says, "This majestic, and formidable species, in strength and magnitude, stands at the head of the whole class of woodpeckers hitherto discovered. He may be called the king or chief of his tribe; and Nature seems to have designed him a distinguished characteristic in the superb carmine crest and bill of polished ivory with which she has ornamented him. His eye is brilliant and daring; and his whole frame so admirably adapted for his mode of life, and method of procuring subsistence, as to impress on the mind of the examiner the most reverential ideas of the Creator. His manners have also a dignity in them superior to the common herd of woodpeckers. Trees, shrubbery, orchards, rails, fence posts, and old prostrate logs, are alike interesting to those, in their humble and indefatigable search for prey; but the royal hunter now before us, scorns the humility of such situations, and seeks the most towering trees of the forest; seeming particularly attached to those prodigious cypress swamps, whose crowded giant sons stretch their bare and blasted, or moss-hung arms midway to the skies. In these almost inaccessible recesses, amid ruinous piles of impending timber, his trumpet-like note and loud strokes resound through the solitary savage wilds, of which he seems the sole lord and inhabitant. Wherever he frequents, he leaves numerous monuments of his industry behind him. We there see enormous pine trees with cart-loads of bark lying around their roots, and chips of the trunk itself in such quantities as to suggest the idea that half-a-dozen of axe-men had been at work there for the whole morning. The body of the tree is also disfigured with such numerous and so large excavations, that one can hardly conceive it possible for the whole to be the work of a woodpecker. With such strength, and an apparatus so powerful, what havoc might he not commit, if numerous, on the most useful of our

forest trees! and yet with all these appearances, and much of vulgar prejudice against him, it may fairly be questioned whether he is at all injurious; or, at least, whether his exertions do not contribute most powerfully to the protection of our timber. Examine closely the tree where he has been at work, and you will soon perceive, that it is neither from motives of mischief nor amusement that he slices off the bark, or digs his way into the trunk.—For the sound and healthy tree is the least object of his attention. The diseased, infested with insects, and hastening to putrefaction, are his favourites; there the deadly crawling enemy have formed a lodgment between the bark and tender wood, to drink up the very vital part of the tree. It is the ravages of these vermin which the intelligent proprietor of the forest deplores, as the sole perpetrators of the destruction of his timber. Would it be believed that the larvæ of an insect, or fly, no larger than a grain of rice, should silently, and in one season, destroy some thousand acres of pine trees, many of them from two to three feet in diameter, and a hundred and fifty feet high! Yet whosoever passes along the high road from Georgetown to Charleston, in South Carolina, about twenty miles from the former place, can have striking and melancholy proofs of this fact. In some places the whole woods, as far as you can see around you, are dead, stripped of the bark, their wintry-looking arms and bare trunks bleaching in the sun, and tumbling in ruins before every blast, presenting a frightful picture of desolation. And yet ignorance and prejudice stubbornly persist in directing their indignation against the bird now before us, the constant and mortal enemy of these very vermin, as if the hand that probed the wound to extract its cause, should be equally detested with that which inflicted it; or as if the thief-catcher should be confounded with the thief. Until some effectual preventive or more complete mode of destruction can be devised against these insects, and their larvæ, I would humbly suggest the propriety of protecting, and receiving with proper feelings of gratitude, the services of this and the whole tribe of woodpeckers, letting the odium of guilt fall to its proper owners.

“In looking over the accounts given of the ivory-billed woodpecker by the naturalists of Europe, I find it asserted, that it inhabits from New Jersey to Mexico. I believe, however, that few of them are ever seen to the north of Virginia, and very few of them even in that state. The first place I observed this bird at, when on my way to the south, was about twelve miles north of Wilmington in North Carolina. Having wounded it slightly in the wing, on being caught, it uttered a loudly reiterated and most piteous note, exactly resembling the violent crying of a young child; which terrified my horse so, as nearly to have cost me my life. It was distressing to hear it. I carried it with me in the chair, under cover, to Wilmington. In passing through the streets, its affecting cries surprised every one within hearing, particularly the females, who hurried to the doors and windows with looks of alarm and anxiety. I drove on, and, on arriving at the piazza of the hotel, where I intended to put up, the landlord came forward, and a number of other persons who happened to be there, all equally alarmed at what they heard; this was greatly increased by my asking, whether he could furnish me with accommodations for myself and my baby. The man looked blank and foolish, while the others stared with still greater astonishment. After diverting myself for a minute or two at their expense, I drew my woodpecker from under the cover, and a general laugh took place. I took him up stairs and locked him up in my room, while I went to see my horse taken care of. In less than an hour I returned, and, on opening the door, he set up the same distressing shout, which now ap-

peared to proceed from grief that he had been discovered in his attempts at escape. He had mounted along the side of the window, nearly as high as the ceiling, a little below which he had begun to break through. The bed was covered with large pieces of plaster; the lath was exposed for at least fifteen inches square, and a hole, large enough to admit the fist, opened to the weather-boards; so that in less than another hour he would certainly have succeeded in making his way through. I now tied a string round his leg, and fastening it to the table, again left him. I wished to preserve his life, and had gone off in search of suitable food for him. As I reascended the stairs I heard him again hard at work, and on entering had the mortification to perceive that he had almost entirely ruined the mahogany table to which he was fastened, and on which he had wreaked his whole vengeance. While engaged in taking a drawing, he cut me severely in several places, and, on the whole, displayed such a noble and unconquerable spirit, that I was frequently tempted to restore him to his native woods. He lived with me nearly three days, but refused all sustenance, and I witnessed his death with regret.”

In his description of the gold-winged woodpecker, Wilson gives another amusing account of the confinement of one of that species. “In rambling through the woods one day, I happened to shoot one of these birds, and wounded him slightly on the wing. Finding him in full feather, and seemingly but little hurt, I took him home, and put him into a large cage, made of willows, intending to keep him in my own room, that we might become better acquainted. As soon as he found himself enclosed on all sides, he lost no time in idle fluttering, but, throwing himself against the bars of the cage, began instantly to demolish the willows, battering them with great vehemence, and uttering a loud piteous kind of cackling, similar to that of a hen when she is alarmed, and takes to wing. Poor Baron Trenck never laboured with more eager diligence at the walls of his prison, than this son of the forest in his exertions for liberty; and he exercised his powerful bill with such force, digging into the sticks, seizing and shaking them so from side to side, that he soon opened for himself a passage; and, though I repeatedly repaired the breach, and barricaded every opening, in the best manner I could, yet on my return into the room, I always found him at large, climbing up the chairs, or running about the floor, where, from the dexterity of his motions, moving backward, forward, and sidewise, with the same facility, it became difficult to get hold of him again. Having placed him in a strong wire cage, he seemed to give up all hopes of making his escape, and soon became very tame; fed on young ears of Indian corn; refused apples, but ate the berries of the sour gum greedily, small winter grapes, and several other kinds of berries; exercised himself frequently in climbing, or rather hopping perpendicularly along the sides of the cage; and, as evening drew on, fixed himself in a high hanging or perpendicular position, and slept with his head in his wing. As soon as dawn appeared, even before it was light enough to perceive him distinctly across the room, he descended to the bottom of the cage, and began his attack on the ears of Indian corn, rapping so loud, as to be heard from every room in the house. After this he would sometimes resume his former position, and take another nap. He was beginning to become very amusing, and even sociable, when, after a lapse of several weeks, he became drooping, and died, as I conceived, from the effects of his wound.”

Of the red-headed woodpecker, the most common in America, the following is Wilson's account. “There is perhaps no bird in North America more universally known than this. His tri-coloured plu-

mage, red, white, and black, glossed with steel blue, is so striking and characteristic; and his predatory habits in the orchards and corn-fields, added to his numbers, and fondness for hovering along the fences, so very notorious, that almost every child is acquainted with the red-headed woodpecker. In the immediate neighbourhood of our large cities, where the old timber is chiefly cut down, he is not so frequently found; and yet at this present time, June, 1808, I know of several of their nests within the boundaries of the city of Philadelphia. Two of these are in button-wood trees (*platanus occidentalis*), and another in the decayed limb of a large elm. The old ones, I observe, make their excursions regularly to the woods beyond the Schuylkill, about a mile distant; preserving great silence and circumspection in visiting their nests,—precautions not much attended to by them in the depth of the woods, because there the prying eye of man is less to be dreaded. Towards the mountains, particularly in the vicinity of creeks and rivers, these birds are extremely abundant, especially in the latter end of summer. Wherever you travel in the interior at that season, you hear them screaming from the adjoining woods, rattling on the dead limbs of trees, or on the fences, where they are perpetually seen flitting from stake to stake, on the roadside, before you. Wherever there is a tree, or trees, of the wild cherry, covered with ripe fruit, there you see them busy among the branches; and, in passing orchards, you may easily know where to find the earliest sweetest apples, by observing those trees, on or near which the red-headed woodpecker is skulking; for he is so excellent a connoisseur in fruit, that wherever an apple or pear tree is found broached by him, it is sure to be among the ripest and best flavoured: when alarmed, he seizes a capital one by striking his open bill deep into it, and bears it off to the woods. When the Indian corn is in its rich, succulent, milky state, he attacks it with great eagerness, opening a passage through the numerous folds of the husk, and feeding on it with voracity. The girdled, or deadened timber, so common among corn-fields in the back settlements, are his favourite retreats, whence he sallies out to make his depredations. He is fond of the ripe berries of the sour gum, and pays pretty regular visits to the cherry trees, when loaded with fruit. Towards fall he often approaches the barn or farm-house, and raps on the shingles and weather boards: he is of a gay and frolicsome disposition; and half a dozen of the fraternity are frequently seen diving and vociferating around the high dead limbs of some large tree, pursuing and playing with each other, and amusing the passenger with their gambols. Their note or cry is shrill and lively, and so much resembles that of a species of tree-frog, which frequents the same tree, that it is sometimes difficult to distinguish the one from the other. Such are the vicious traits, if I may so speak, in the character of the red-headed woodpecker; and I doubt not but, from what has been said on this subject, that some readers would consider it meritorious to exterminate the whole of this tribe as a nuisance: and, in fact, the legislature of some of our provinces, in former times, offered premiums to the amount of twopence per head for their destruction. But let us not condemn the species unheard: they exist; they must therefore be necessary. If their merits and usefulness be found, on examination, to preponderate against their vices, let us avail ourselves of the former, while we guard as well as we can against the latter.

"Though this bird occasionally regales himself on fruit, yet his natural and most usual food is insects, particularly those numerous and destructive species that penetrate the bark and body of the tree to deposit their eggs and larvæ, the latter of which

are well known to make immense havoc. That insects are his natural food is evident from the construction of his wedge-formed bill, the length, elasticity, and figure of his tongue, and the strength and position of his claws; as well as from his usual habits. In fact, insects form at least two-thirds of his subsistence; and his stomach is scarcely ever found without them. He searches for them with a dexterity and intelligence, I may safely say, more than human; he perceives, by the exterior appearance of the bark, where they lurk below; when he is dubious, he rattles vehemently on the outside with his bill, and his acute ear distinguishes the terrified vermin shrinking within to their inmost retreats, where his pointed and barbed tongue soon reaches them. The masses of bugs, caterpillars, and other larvæ, which I have taken from the stomachs of these birds, have often surprised me. These larvæ, it should be remembered, feed not only on the buds, leaves, and blossoms, but on the very vegetable life of the tree, the alburnum, or newly forming bark and wood; the consequence is, that whole branches and whole trees decay under the silent ravages of these destructive vermin; witness the late destruction of many hundred acres of pine trees, in the north-eastern parts of South Carolina; and the thousands of peach trees that yearly decay from the same cause. Will any one say, that, taking half a dozen, or half a hundred, apples from a tree is equally ruinous with cutting it down? or, that the services of a useful animal should not be rewarded with a small portion of that which it has contributed to preserve? We are told, in the benevolent language of the Scriptures, not to muzzle the mouth of the ox that treadeth out the corn; and why should not the same generous liberality be extended to this useful family of birds, which forms so powerful a phalanx against the inroads of many millions of destructive vermin?

"Notwithstanding the care which this bird, in common with the rest of its genus, takes to place its young beyond the reach of enemies, within the hollows of trees, yet there is one deadly foe, against whose depredations neither the height of the tree, nor the depth of the cavity, is the least security. This is the black snake (*coluber constrictor*), who frequently glides up the trunk of the tree, and, like a sculking savage, enters the woodpecker's peaceful apartment, devours the eggs or helpless young, in spite of the cries and flutterings of the parents; and if the place be large enough, coils himself up in the spot they occupied, where he will sometimes remain for several days. The eager schoolboy, after hazarding his neck to reach the woodpecker's hole, at the triumphant moment when he thinks the nestlings his own, and strips his arm, launching it down into the cavity, and grasping what he conceives to be the callow young, starts with horror at the sight of a hideous snake, and almost drops from his giddy pinnacle, retreating down the tree with terror and precipitation. Several adventures of this kind have come to my knowledge; and one of them that was attended with serious consequences, where both snake and boy fell to the ground; and a broken thigh, and long confinement, cured the adventurer completely of his ambition for robbing woodpeckers' nests."

Throughout his descriptions, Wilson is warm in defending the character of the woodpeckers from the aspersions of Buffon, and the prejudices of farmers. Of the downy woodpecker he says, "this is the smallest of our woodpeckers, and so exactly resembles the former (the hairy woodpecker) in its tints and markings, and in almost every thing except its diminutive size, that I wonder how it passed through the Count de Buffon's hands without being branded as a 'spurious race, degenerated by the influence of food,

climate, or some unknown cause.' But, though it has escaped this infamy, charges of a much more heinous nature have been brought against it, not only by the writer above-mentioned, but by the whole venerable body of zoologists in Europe who have treated of its history, viz. that it is almost constantly boring and digging into apple-trees; and that it is the most destructive of its whole genus to the orchards. The first part of this charge I shall not pretend to deny; how far the other is founded in truth will appear in the sequel. Like the two former species, it remains with us the whole year. About the middle of May, the male and female look out for a suitable place for the reception of their eggs and young. An apple, pear, or cherry tree, often in the near neighbourhood of the farm-house, is generally pitched upon for this purpose. The tree is minutely reconnoitred for several days previous to the operation, and the work is first begun by the male, who cuts out a hole in the solid wood, as circular as if described with a pair of compasses. He is occasionally relieved by the female, both parties working with the most indefatigable diligence. The direction of the hole, if made in the body of the tree, is generally downwards, by an angle of thirty or forty degrees, for the distance of six or eight inches, and then straight down for ten or twelve more; within roomy, capacious, and as smooth as if polished by the cabinet-maker; but the entrance is judiciously left just so large as to admit the bodies of the owners. During this labour, they regularly carry out the chips, often strewing them at a distance to prevent suspicion. This operation sometimes occupies the chief part of a week. Before she begins to lay, the female often visits the place, passes out and in, examines every part both of the exterior and interior, with great attention, as every prudent tenant of a new house ought to do, and at length takes complete possession. The eggs are generally six, pure white, and laid on the smooth bottom of the cavity. The male occasionally supplies the female with food while she is sitting; and about the last week in June the young are perceived making their way up the tree, climbing with considerable dexterity. All this goes on with great regularity where no interruption is met with; but the house wren, who also builds in the hollow of a tree, but who is neither furnished with the necessary tools nor strength for excavating such an apartment for himself, allows the woodpeckers to go on, till he thinks it will answer his purpose, then attacks them with violence, and generally succeeds in driving them off. I saw some weeks ago a striking example of this, where the woodpeckers we are now describing, after commencing in a cherry-tree within a few yards of the house, and having made considerable progress, were turned out by the wren; the former began again on a pear-tree in the garden, fifteen or twenty yards off, whence, after digging out a most complete apartment, and one egg being laid, they were once more assaulted by the same impertinent intruder, and finally forced to abandon the place.

"The principal characteristics of this little bird are diligence, familiarity, perseverance, and a strength and energy in the head and muscles of the neck, which are truly astonishing. Mounted on the infected branch of an old apple-tree, where insects have lodged their corroding and destructive brood in crevices between the bark and wood, he labours sometimes for half an hour incessantly at the same spot, before he has succeeded in dislodging and destroying them. At these times you may walk up pretty close to the tree, and even stand immediately below it, within five or six feet of the bird, without in the least embarrassing him; the strokes of his bill are distinctly heard several hundred yards off; and I have known him to be at work for two hours to-

gether on the same tree. Buffon calls this 'incessant toil and slavery,' their attitude 'a painful posture,' and their life 'a dull and insipid existence;' expressions improper, because untrue: and absurd, because contradictory. The posture is that for which the whole organization of his frame is particularly adapted; and though, to a wren or a humming-bird, the labour would be both toil and slavery, yet to him it is, I am convinced, as pleasant and as amusing, as the sports of the chase to the hunter, or the sucking of flowers to the humming-bird. The eagerness with which he traverses the upper and lower sides of the branches; the cheerfulness of his cry, and the liveliness of his motions while digging into the tree and dislodging the vermin, justify this belief. He has a single note, or *chink*, which, like the former species, he frequently repeats. And when he flies off, or alights on another tree, he utters a rather shriller cry, composed of nearly the same kind of note, quickly reiterated. In fall and winter, he associates with the titmouse, creeper, &c. both in their wood and orchard excursions; and usually leads the van. Of all our woodpeckers, none rid the apple-trees of so many vermin as this, digging off the moss which the negligence of the proprietor had suffered to accumulate, and probing every crevice. In fact, the orchard is his favourite resort in all seasons; and his industry is unequalled, and almost incessant, which is more than can be said of any other species we have. In fall, he is particularly fond of boring the apple-trees for insects, digging a circular hole through the bark just sufficient to admit his bill, after that a second, third, &c. in pretty regular horizontal circles round the body of the tree; these parallel circles of holes are often not more than an inch or an inch and a half apart, and sometimes so close together, that I have covered eight or ten of them at once with a dollar. From nearly the surface of the ground up to the first fork, and sometimes far beyond it, the whole bark of many apple-trees is perforated in this manner, so as to appear as if made by successive discharges of buck-shot; and our little woodpecker, the subject of the present account, is the principal perpetrator of this supposed mischief.—I say supposed, for so far from these perforations of the bark being ruinous, they are not only harmless, but, I have good reason to believe, really beneficial to the health and fertility of the tree. I leave it to the philosophical botanist to account for this; but the fact I am confident of. In more than fifty orchards which I have myself carefully examined, those trees which were marked by the woodpecker (for some trees they never touch, perhaps because not penetrated by insects), were uniformly the most thriving, and seemingly the most productive; many of these were upwards of sixty years old, their trunks completely covered with holes, while the branches were broad, luxuriant, and loaded with fruit. Of decayed trees, more than three-fourths were untouched by the woodpecker. Several intelligent farmers, with whom I have conversed, candidly acknowledge the truth of these observations, and with justice look upon these birds as beneficial; but the most common opinion is, that they bore the trees to suck the sap, and so destroy its vegetation; though pine and other resinous trees, on the juices of which it is not pretended they feed, are often found equally perforated. Were the sap of the tree their object, the saccharine juice of the birch, the sugar maple, and several others, would be much more inviting, because more sweet and nourishing than that of either the pear or apple tree; but I have not observed one mark on the former for ten thousand that may be seen on the latter; besides, the early part of spring is the season when the sap flows most abundantly; whereas it is only during the months of September, October, and November, that

length, three-fourths of one-twelfth in breadth at the commencement, gradually tapering to a blunt point, convex on its lower surface, concave or channelled on the upper, passing under and internally of the articulation of the jaw, and curving upwards along the occiput, until the two meet on the top of the head, at the level of the posterior margin of the orbit, in the median line of the cranium, which is much depressed, whence they proceed in mutual contact, inclining slightly to the right side, and terminate a little before the anterior margin of the orbit, half-an-inch behind the right nostril, and a quarter of an inch from the base of the bill. These prolongations of the os hyoides, being of an osseo-cartilaginous nature, are possessed of much elasticity, so as in some measure to resemble a curved spring.

From near the angle or point of union of the two crura of the lower mandible internally, there proceeds on each side a slender muscle, *o o*, which, running backwards, comes in contact with the prolongation of the hyoid bone, at the joint between the apo-hyal and cerato-hyal portions, and is thence continued along the whole extent of the later *og, og*, running chiefly along its upper side, but partially enclosing it, and bound to it by a sheath of cellular tissue, which allows it considerable motion. The bone and muscle together are enclosed in an extremely delicate, transparent, tenacious sheath, moistened internally with a serous fluid, and terminating at the end of the bone, where it is attached by elastic tissue to the cellular substance and periosteum near the base of the bill. This delicate sheath, perfectly smooth and lubricated on its inner surface, is on the outer attached by delicate filaments to the dense cellular tissue which forms a kind of external sheath. It is fixed in its place, and the hyoid bone, with its muscle, *gg*, slides backwards and forwards in it.

The entire length from the tip of the tongue, *c*, to the tip of each prolongation of the hyoid bone at *e*, is seven inches two-twelfths. The protrusion of the tongue is effected by the contraction of the slender muscle above described, *o*, which having a fixed basis in the lower jaw near its angle, and acting upon the tip of the hyoid bone, which is in this bird situated anteriorly to the eye, on the forehead, near the base of the upper mandible at *c*, causes the hyoid bone to glide within its sheath until its tip has moved backwards over the forehead, the crown, and occiput, and then advanced forwards until beneath the articulation of the lower jaw, thus traversing a space of three inches and a half, so that the tongue is protruded to three inches and four-twelfths beyond the tip of the bill. When the muscle is relaxed, the parts regain their ordinary position by the aid of the elasticity of the prolongation of the hyoid bones, and the action of another pair of muscles, to be presently described.

The tongue, *d*, is covered externally with a dense sheath of fibrous tissue. On its lower surface is seen on each side a very slender muscle, commencing at the extremity of the glosso-hyal bone, and running along the whole length of the basi-hyal bone, as well as of the apo-hyal, to be inserted into the cerato-hyal, at the distance of one inch from its base, on the outer edge. The action of this muscle, which has a strong tendon in its whole length, is to bend the tip of the tongue downwards, or to move the horn of the hyoid bone outwards. It may be called the glosso-hyal. It has another tendon running parallel to that mentioned along its upper edge, of which the action must be to bend the tongue upwards upon the apo-hyal. Besides these muscles, there is another pair, forming the greater part of the fleshy portion of the tongue. They commence at the tip of the basi-hyal bone, or, at *d*, proceed along the upper surface of the tongue, and, after running a course of two inches and three-fourths, pass along

the anterior surface of the thyroid bone, wind along its edge, and are inserted near the middle surface of the trachea, about its tenth ring. The action of these muscles, alluded to at the end of the last paragraph, and marked *nn*, is to retract the tongue, when extended, as well as to pull forward the larynx. Another pair of very slender muscles, *mm*, commence upon the edge of the thyroid bone externally of those last described, separate immediately from the trachea, pass directly down the neck in front, under the subcutaneous muscle and skin, to which they are firmly attached by cellular tissue, and are inserted into the furcular bone about the middle of its length. These muscles, the cleido-tracheales, are not peculiar to woodpeckers, and have nothing particular to do with the movements of the tongue in those birds.

Parallel to the lower edge of the jaw, and extending from four-twelfths anteriorly to its articulation to the junction of its crura, is, on each side, an elongated salivary gland, *ff*, attached to the jaw by cellular tissue. It is of a yellowish colour, internally parenchymatous, and sends off a duct, which enters the mouth by the aperture already mentioned, at the commencement of the groove, in the horny part of the lower mandible. The fluid which it secretes is a glairy mucus, of a whitish colour, which, being poured forth around the tip of the tongue, covers it with a glutinous substance well adapted for causing the adhesion of any small body to it.

The ivory-billed woodpecker, then, having discovered an insect or larva in a chink of the bark, is enabled, by suddenly protruding its tongue, covered with thick mucus, and having a strong, slender, sharp point furnished with small reversed prickles, to seize it and draw it into the mouth. These prickles are of special use in drawing from its retreat in the wood those large larvae, often two or three inches in length; but it does not appear probable that the bristly point is ever used to *transfix* an object, otherwise, how should the object be again set free without tearing off the prickles, which are extremely delicate, and not capable of being bent in every direction?

The trachea, *kk*, is five inches four-twelfths in length, considerably flattened, nearly of the uniform breadth of three-twelfths throughout. The aperture of the glottis is four-twelfths long, with a posterior flap of several series of papillæ. The rings of the trachea are very strong, firmly ossified, 92 in number. At the upper part three are incomplete, the last entire ring is very broad and bipartite, and there are two additional dimidiate rings. The bronchi are short, of twelve half rings. The lateral or contractor muscles, *ll*, commence in front, at the base of the thyroid bone, diverge, presently become lateral, and thus proceed until four and one-half-twelfths from the extremity, when they terminate partly in the sterno-tracheal, but also send down a very thin slip, which is inserted on the first dimidiate ring.

The explanation of the mechanism by which the tongue is protruded as above given, differs materially from any of those to be found in English works at least, in some of which there is a very unnecessary prolixity as well as ambiguity. It does not appear that hitherto the real sheath in which the horns of the hyoid bone, with its muscle, move, has been observed, and the two very slender muscles which run from the sides of the thyroid bone to the furcula, are common to almost all birds, although they have been supposed to be peculiar to woodpeckers.

NOTE C.—Of the Nut-hatch tribe in general.

The characters of this tribe are, a bill for the most part straight, having on the lower mandible a small angle: small nostrils, covered with bristles: a short

tongue, horny at the end, and jagged: toes placed three forwards, and one backwards; the middle toe joined closely at the base to both the outer, and the back toe as large as the middle one. In the habits and manners of the different species of the nut-hatch, we observe a very close alliance to the woodpeckers. Most of them feed upon insects; and some on nuts, whence their English appellation has been acquired.

The European Nut-hatch. The length of this bird is five inches and three quarters. The bill is strong and straight, about three quarters of an inch long; the upper mandible is black, and the lower white. All the upper part of the body is of a bluish gray: the cheeks and chin are white: the breast and belly pale orange colour; and the quills dusky: the tail is short, and consists of twelve feathers; the two middle ones of which are gray, the two outer spotted with white, and the rest dusky. The legs are pale yellow; the claws are large, and the back one very strong.

The nut-hatch, the squirrel, and the field-mouse, which all live much on hazel nuts, have each a curious way of getting at the kernel. Of the two latter, the squirrel, after rasping off the small end, splits the shell in two with his long fore-teeth, as a man does with his knife; the field-mouse nibbles a hole with his teeth, as regular as if drilled with a wimble, and yet so small that one would wonder how the kernel could be extracted through it; while the nut-hatch picks an irregular ragged hole with his bill. But as this last artist has no paws to hold the nut firm while he pierces it, he, like an adroit workman, fixes it as it were in a vice, in some cleft of a tree, or in some crevice, when standing over it he perforates the stubborn shell. On placing nuts in the chink of a gate-post, where nut-hatches have been known to haunt, it has always been found that these birds have readily penetrated them. While at work they make a rapping noise, which may be heard a considerable distance. Dr. Plott informs us, that this bird, by putting his bill into a crack in the bough of a tree, sometimes makes a violent sound, as if the branch was rending asunder. Besides nuts it feeds also on caterpillars, beetles, and various other insects.

The female deposits her eggs, six or seven in number, in some hole of a tree, frequently in one that has been deserted by the woodpecker, on rotten wood mixed with moss. If the entrance be too large, she nicely stops up part of it with clay, leaving only a small hole for herself to pass in and out. While the hen is sitting, if a stick be put in the hole, she hisses like a snake, and she is so much attached to her eggs, that she will sooner suffer any one to pluck off her feathers than fly away. During the time of incubation, she is assiduously attended by the male, who supplies her with food. If the barrier of plaster at the entrance of the hole be destroyed, while these birds have eggs, it is speedily replaced; a peculiar instinct, to prevent their nest from being destroyed by the woodpecker, and other birds of superior size and strength, which build in similar situations. The nut-hatch is not supposed to sleep perched, like most other birds, on a twig; for it has been observed, that when kept in a cage, notwithstanding it would perch now and then, yet at night it generally crept into some hole or corner to sleep. And it is remarkable, when perched, or otherwise at rest, it had mostly the head downwards, or at least even with the body, and not elevated like other birds.

Allied to the nut-hatch are the creepers and hoopoes. Creepers scale trees in the same manner as woodpeckers, and, like them, are supported behind by their stiff deflected tail. They feed entirely on insects. The hoopoes frequent the south of Europe in the summer months, but in winter retire to Asia and Africa. They build in decayed trees, and live on insects.

CHAP. V.

OF THE BIRD OF PARADISE, AND ITS VARIETIES.

THERE are few birds that have more deceived and puzzled the learned than this. Some have described it as an inhabitant of the air, living only upon the dew of heaven, and never resting below; others have acquiesced in the latter part of its history, but have given it flying insects to feed on. Some have asserted that it was without feet, and others have ranked it among the birds of prey.

The great beauty of this bird's plumage, and the deformity of its legs, seem to have given rise to most of these erroneous reports. The native savages of the Molucca islands, of which it is an inhabitant, were very little studious of natural history; and, perceiving the inclination the Europeans had for this beautiful bird, carefully cut off its legs before they brought it to market; thus concealing its greatest deformity, they considered themselves entitled to rise in their demands when they offered it for sale. One deceit led on to another; the buyer finding the bird without legs, naturally inquired after them; and the seller as naturally began to assert that it had none. Thus far the European was imposed upon by others; in all the rest he imposed upon himself. Seeing so beautiful a bird without legs, he concluded that it could live only in air, where legs were unnecessary. The extraordinary splendour of its plumage assisted this deception; and, as it had heavenly beauty, so it was asserted to have a heavenly residence. From thence its name, and all the false reports that have been propagated concerning it.

Error, however, is shortlived; and time has discovered that this bird not only has legs, but very large strong ones for its size. Credulity, when undeceived, runs into the opposite extreme; and soon after this harmless bird was branded with the character of being rapacious, of destroying all those of smaller size, and from the amazing rapidity of its flight, as qualified peculiarly for extensive rapine. The real history of this pretty animal is at present tolerably well known; and it is found to be as harmless as it is beautiful.

There are two kinds of the bird of Paradise; one about the size of a pigeon, which is more common; the other not much larger than a lark, which has been described more imperfectly. They are both sufficiently distinguished from all other birds, not only by the superior vivacity of their tints, but by the feathers of the tail, there being two long slender filaments growing from the upper part of the rump; these are longer than the bird's body, and bearded only at the end. By this mark the bird of Paradise may be easily known, but still more easily by its gaudy livery, which, being so very brilliant, demands to be minutely described.

This bird appears to the eye as large as a pigeon, though in reality the body is not much greater than that of a thrush. The tail, which is about six inches, is as long as the body; the wings are large, compared with the bird's other dimensions. The head, the throat, and the neck, are of a pale gold colour. The base of the bill is surrounded by black feathers, as also the side of the head and throat, as soft as velvet, and changeable like those on the neck of a mallard. The hinder part of the head is of a shining green, mixed with gold. The body and wings are chiefly covered with beautiful brown, purple, and gold feathers. The uppermost part of the tail-feathers is of a pale yellow, and those under them white, and longer than the former; for which reason the hinder part of the tail appears to be all white. But what chiefly excites curiosity are, the two long naked feathers above-mentioned, which spring from the upper part of the rump above the tail, and which are usually about three feet long. These are bearded only at the beginning and the end; the whole shaft, for about two feet nine inches, being of a deep black, while the feathered extremity is of a changeable colour, like the mallard's neck.

This bird, which for beauty exceeds all others of the pie kind, is a native of the Molucca islands, but found in greatest numbers in that of Aro. There, in the delightful and spicy woods of the country, do these beautiful creatures fly in large flocks; so that the groves which produce the richest spices produce the finest birds also. The inhabitants themselves are not insensible of the pleasure these afford, and give them the name of God's birds, as being superior to all others that he has made. They live in large flocks, and at night generally perch upon the same tree. They are called by some, the *swallows of Ternate*, from their rapid flight, and from their being continually on the wing in pursuit of insects, their usual prey.

As the country where they are bred has its tempestuous season, when rains and thunders continually disturb the atmosphere, these birds are then but seldom seen. It is thought that they then fly to other countries, where their food appears in greater abundance; for, like swallows, they have their stated times of return. In the beginning of the month of August, they are seen in great numbers flying together; and as the inhabitants would have us believe, following their king, who is distinguished from the rest by the lustre of his plumage, and that respect and veneration which is paid him.¹ In the evening

¹ They always migrate in flocks of thirty or forty, and have a leader, which the inhabitants of Aro call the king. He is said to be black, to have red spots, and to fly far above the flock, which never desert him, but always settle in the same place that he does. They never fly with the wind, as in that case their loose plumage would be ruffled, and blown over their heads; and a change of wind, often compels them to alight on the ground, from

they perch upon the highest trees of the forest, particularly one which bears a red berry, upon which they sometimes feed, when other food fails them. In what manner they breed, or what may be the number of their young, as yet remains for discovery.

The natives, who make a trade of killing and selling these birds to the Europeans, generally conceal themselves in the trees where they resort, and having covered themselves up from sight in a bower made of the branches, they shoot at the birds with reedy arrows; and, as they assert, if they happen to kill the king, they then have a good chance for killing the greatest part of the flock. The chief mark by which they know the king is by the end to the feathers in his tail, which have eyes like those of a peacock. When they have taken a number of these birds, their usual method is to gut them, and cut off their legs; they then run a hot iron into the body, which dries up the internal moisture; and filling the cavity with salts and spices, they sell them to the Europeans for a perfect trifle.

which they cannot rise without great difficulty. When they are surprised by a heavy gale, they instantly soar to a higher region, beyond the reach of the tempest. There, in a serene sky, they float at ease on their light flowing feathers, or pursue their journey in security. During their flight they cry like starlings; but when a storm blows in their rear, they express their distressed situation by a note somewhat resembling the croaking of a raven. In calm weather, great numbers of these birds may be seen flying, both in companies and singly, in pursuit of the large butterflies and other insects, on which they feed.—ED.

SUPPLEMENTARY NOTE.

The general colour of these birds is chestnut, with a neck of a golden green, beneath. The feathers of the back and sides are considerably longer than those of the body. They have two long tail-feathers, which are straight, and taper at the tip.

There have been ten species of this bird lately discovered.

The Grakle bird of Paradise.—It has a triangular naked space behind the eyes; the head and neck are brown; the bill and legs are yellow; the body brownish; the first quill feathers white, from the base to the middle; the tail-feathers, except the middle one, are tipped with white. It inhabits the Philippine Islands; is nine and a half inches long; feeds on fruit, insects, mice, and every kind of grain. It builds twice a-year, in the forked branches of trees, and lays four eggs. When young it is easily tamed, and becomes docile and imitative. This bird has a great affinity in all its habits to the Grakle genus; yet, on account of the downy feathers at the base of the bill, it is placed here.

The magnificent bird of Paradise.—This elegant species, so remarkable for the splendour and variety of its colours, is principally found in the Molucca Islands, and is somewhat smaller than the common bird of paradise. The bill is surrounded at the base with velvet-like feathers; the chin is green, with golden lunules; crown with a tuft of yellow feathers; the first quill feathers are brown, and the secondary of a deep yellow; the middle tail-feathers are very long, with a very short fringe; its legs and bill are yellow, the latter black at the tip. This beautiful bird inhabits New Holland, and is nine inches long.

CHAP. VI.

THE CUCKOO, AND ITS VARIETIES.

FROM a bird of which many fables have been reported, we pass to another that has not given less scope to fabulous invention. The note of the cuckoo is known to all the world; the history and nature of the bird itself still remain in great obscurity. That it devours its parent, that it changes its nature with the season, and becomes a sparrow-hawk, were fables invented of this bird, and are now sufficiently refuted. But where it resides in winter, or how it provides for its supply during that season, still continues undiscovered.

This singular bird, which is somewhat less than a pigeon, and of a grayish colour, is distinguished from all other birds by its round prominent nostrils. Having disappeared all the winter, it discovers itself in our country early in the spring, by its well-known call. Its note is heard earlier or later, as the season seems to be more or less forward, and the weather more or less inviting. From the cheerful voice of this bird the farmer may be instructed in the real advancement of the year. The fallibility of human calendars is but too well known; but from this bird's note the husbandman may be taught when to sow his most useful seeds, and to do such work as depends upon a certain temperature of the air. These feathered guides come to us heaven-taught, and point out the true commencement of the season.

The cuckoo, that was silent some time after its appearance, begins, at first feebly, and at very distant intervals, to give its call, which, as the summer advances, improves both in its frequency and loudness. This is an invitation to courtship, and used only by the male, who sits generally perched upon some dead tree, or bare bough, and repeats his song, which he loses as soon as the genial season is over. His note is pleasant, though uniform; and, from an association of ideas, seldom occurs to the memory without reminding us of the sweets of summer. Custom too has affixed a more ludicrous association to this note; which, however, we that are bachelors need be in no pain about. This reproach seems to arise from this bird's making use of the bed or nest of another to deposit its own brood in.

However this may be, nothing is more certain than that the female makes no nest of her own. She repairs for that purpose to the nest of some other bird, generally the water-wagtail or hedge-sparrow, and having devoured the eggs of the owner, lays her own in their place.¹ She usually lays but one, which is speckled, and of the size

¹ The only other bird which is known to deposit its eggs in another's nest is the cattle-bird, or cow-bunting, of North America.—Ed.

of a blackbird's. This the fond foolish bird hatches with great assiduity, and, when excluded, finds no difference in the great ill-looking changeling from her own. To supply this voracious creature, the credulous nurse toils with unusual labour, no way sensible that she is feeding up an enemy to her race, and one of the most destructive robbers of her future progeny.²

It was once doubted whether these birds were carnivorous; but Reaumur was at the pains of breeding up several, and found that they would not feed upon bread or corn; but flesh and insects were their favourite nourishment. He found it a very difficult task to teach them to peck; for he was obliged to feed them a full month after they were grown as big as the mother. Insects, however, seemed to be their peculiar food when young; for they devoured flesh by a kind of constraint, as it was always put into their mouths; but meal-worm insects they flew to, and swallowed of their own accord most greedily. Indeed, their gluttony is not to be wondered at, when we consider the capacity of their stomach, which is enormous, and reaches from the breastbone to the vent. It is partly membranous, partly muscular, and of a prodigious capacity; yet still they are not to be supposed as birds of prey, for they have neither the strength nor the courage. On the contrary, they are naturally weak and fearful, as appears by their flying from small birds, which everywhere pursue them. The young birds are brown, mixed with black; and in that state they have been described by some authors as old ones.

The cuckoo, when fledged and fitted for flight, follows its supposed parent but for a little time; its appetite for insect food increasing, as it finds no great chance for a supply in imitating its little instructor, it parts good friends, the step-child seldom offering any violence to its nurse. Nevertheless, all the little birds of the grove seem to consider the young cuckoo as an enemy, and revenge the cause of their kind by their repeated insults. They pursue it wherever it flies, and oblige it to take shelter in the thickest branches of some neighbouring tree. All the smaller birds

² "As the young of the cuckoo," says Colonel Montague, "differs so materially in the first year's plumage from the adult, it may not be improper to give a description for the information of those who may wish to know the distinction. The irides are grayish; the whole upper part of the plumage is a mixture of dusky black and ferruginous in transverse bars, except the forehead, and a patch on the back of the head, which (in this specimen) is white; and the tips of the scapulars are pale: the feathers of the whole under parts are sullied white, with distant transverse bars of dusky black. In general each feather possesses two or three bars: the sides of the neck and breast tinged with rufous: the lateral feathers of the tail, and the inner webs of the quills, more or less barred with white; the coverts of the tail, which, as well as those on the rump, are unusually long, dashed with cinereous, and slightly tipped with white."—Ed.

the train of its pursuers; but the wryneck, particularly, is found the most active in the chase; and from thence it has been called by many, the cuckoo's attendant and provider. But it is very far from following with a friendly intention; it only pursues as an insulter, or a spy, to warn all its little companions of the cuckoo's predations.³

Such are the manners of this bird while it continues to reside or to be seen amongst us. But early, at the approach of winter, it totally disappears, and its passage can be traced to no other country. Some suppose that it lies hid in hollow trees; and others that it passes into warmer climates. Which of these opinions is true is very uncertain, as there are no facts related on either side that can be totally relied on. To support the opinion that they remain torpid during the winter at home, Willoughby introduces the following story, which he delivers upon the credit of another: "The servants of a gentleman, in the country, having stocked up in one of their meadows some old, dry, rotten willows, thought proper, on a certain occasion, to carry them home. In heating a stove, two logs of this timber were put into the furnace beneath, and fire applied as usual. But soon, to the great surprise of the family, was heard the voice of a cuckoo, singing three times from under the stove. Wondering at so extraordinary a cry in the winter-time, the servants ran and drew the willow logs from the furnace, and in the midst of one of them saw something move; wherefore, taking an axe, they opened the hole, and thrusting in their hands, first they plucked out nothing but feathers; afterwards they got hold of a living animal; and this was the cuckoo, that had waked so very opportunely for its own safety. It was indeed," continues our historian, "brisk and lively, but wholly naked and bare of feathers, and without any winter provision in its hole. This cuckoo the boys kept two years afterwards alive in the stove; but whether it repaid them with a second song, the author of the tale has not thought fit to inform us."

The most probable opinion on this subject is,

³ "Most small birds exhibit a marked hostility towards the young cuckoo, as well as to the old, and no sooner does it leave the nest, than the place of its retreat is sure to be made known by a concourse of swallows and other small birds, endeavouring, as much as they can, to annoy it; amongst all which turmoil, its foster-parents continue to feed it with the most exemplary and indefatigable perseverance. It is remarked of the individual described in a former paper, that 'it was seen again on June 12th, on the top of a wall near to the nest; and, while it was sitting here, an amusing and instructive sight presented itself. A thrush, which probably had a nest close by, in an adjoining garden, evinced the most passionate and marked antipathy towards the young cuckoo, by approaching it with feathers ruffled, beak open, and uttering an earnest cry: some small birds, too, drew near, as if to exhibit their dislike, and abet the thrush.' This I know to be an ordinary fact."—*Mr. E. Blyth.*

that as quails and woodcocks shift their habitations in winter, so also does the cuckoo; but to what country it retires, or whether it has ever been seen on its journey, are questions that I am wholly incapable of resolving.⁴

Of this bird there are various kinds in various parts of the world, not only differing in their colours, but their size. Brisson makes not less than twenty-eight sorts of them; but what analogy they bear to our English cuckoo I will not take upon me to determine. He talks of one, particularly of Brazil, as making a most horrible noise in the forests; which, as it should seem, must be a very different note from that by which our bird is distinguished at home.

⁴ The cuckoo arrives in the south of England about the 18th of April. It is seldom heard there after the 10th or 15th of July. In Belgium it is frequently heard towards the close of July. In Russia it has been seen in August.—*Ed.*

SUPPLEMENTARY NOTE.

The cuckoo makes its appearance with us in the month of April, and departs again about the latter part of June, or the beginning of July. But the young birds are often observed to remain for a much longer period. The reputed story of the cuckoo making no nest of its own, but depositing its egg in that of some other bird, to be hatched, and the young one reared by foster parents, has, within these late years, been fully substantiated, and found to have its origin in fact. It appears that the nest of the hedge-accentor is the one most frequently selected by the cuckoo in the south of England; sometimes, however, that of the yellow-hammer, the wag-tail, and the meadow-pipit, answer its purpose. In Northumberland, the nest of the last-mentioned bird is the one almost always chosen. Taking advantage of the absence of its dupe, during the time of laying (which generally occupies four or five days), the cuckoo deposits its egg among the rest, abandoning it, from that moment, to the care of the foster parent. As the same period of incubation is common to both birds, the eggs are hatched nearly together, which no sooner takes place, than the young cuckoo proceeds instinctively to eject its young companions, and any remaining eggs, from the nest. To effect this object, it contrives to work itself under its burden (the back, at this early age, being provided with a peculiar depression between the shoulders), and shuffling backwards to the edge of the nest, by a jerk rids itself of the encumbrance; and this operation is repeated, till the whole being thrown over, it remains sole possessor. This particular tendency prevails for about twelve days, after which the hollow space between the shoulders is filled up; and when prevented from accomplishing its purpose till the expiration of that time, as if conscious of inability, it suffers its companions to remain unmolested. The egg of the cuckoo is very small in proportion to the size of the bird, which circumstance is in close connection with the instinct, that directs it to choose for its depository the nest of a smaller species. If it selected that of a larger bird, the offspring that its young one would have to contend with, being its equal, perhaps its superior, in size and weight, would consequently frustrate the design, and the young cuckoo would perish in the vain endeavour at the sole possession of the nest. It is an opinion very commonly entertained, that this bird sucks the other eggs in the nest, where it deposits its own, but there appears to be no reason for supposing this to be the

case; the belief has, without doubt, arisen from the fact of the young cuckoo being so often found sole tenant, after the expulsion of its copartners. It has been suggested by Montagu, that the cuckoo may possess the power of retaining its egg in the oviduct at pleasure, otherwise it would be difficult to account for some phenomena connected with its history. On this subject Mr. Blyth says: "There is reason to believe, I think, from the appearance of the ovarium of a cuckoo, that the eggs are not laid on consecutive days, as is the case with birds in general, and that usually but one set, comprising only about five or six, is laid in a season (which, by the way, are quite as many as are ordinarily produced by the nightingale); and I think that this view is further borne out by the very small number of cuckoos' eggs, and of young cuckoos, which are ever found. I also do not imagine, with some people, that the hen cuckoo ever experiences any great difficulty in finding a sufficient number of suitable nests to lay in, more especially on the supposition that more than a day intervenes between each successive laying; her season for laying is when birds' nests are found in greatest abundance; and I think it not very improbable, that, whenever she has found one which will answer her purpose, she continues in the immediate vicinity of the spot until ready to lay into it. I am a little inclined to suspect, also, that, whilst the generality of wild birds mostly lay their eggs early in the morning, at least before ten o'clock A. M., the cuckoo does not lay hers till much later in the day, which, in general, would prevent her from being surprised by the owners of the nest; for, from the time when a nest is finished, to that when the bird begins to sit, the latter is but rarely seen, during the day, about the place, as this would not unfrequently only lead to its discovery."

The continuation of the species appears to require such a provision to have been granted, for, as Montagu observes, if the cuckoo was obliged, like other birds, to lay its eggs, five or six in number, successively day after day, it is hardly probable it could find (within that time) sufficient nests in the exact state to receive them; much less, if it laid a greater number of eggs, as has been suggested. The rare occurrence of the cuckoo's egg being found, gives additional strength to this supposition, for although the old birds may be seen in abundance, such a discovery has seldom been made.

Naturalists have been puzzled to account for this bird not performing the office of incubation, but as their researches have principally been directed to the anatomical structure, in which point it does not essentially differ from many others that perform this office, we arrive by these means at nothing satisfactory. The above peculiarity of this remarkable genus must not probably be looked for in any principle of conformation, but must be explained from their habits and economy. Let it be remembered that these birds are migratory, and that the period during which the adults remain with us is very short; but the propagation of the species must be effected during that period. Now, as their arrival does not take place before the month of April, and the egg is seldom ready for incubation before the middle of May, there would not be sufficient length of time for the young to be hatched, or (making every allowance), sufficiently fledged to accompany the old birds at the period of their departure, which seldom or never extends beyond the first week in July. The egg requires a fortnight's incubation, and the young are not able to fly in less than five or six weeks, which facts have been ascertained from repeated observation.

With regard to the cuckoo remaining in this country during the winter, in a state of torpidity, concealed in the hollows of trees, or in the thickest

parts of furze-bushes, one or two instances of such an occurrence are not sufficient authority upon which to build a general assertion; those denuded cuckoos mentioned by Willoughby and Bewick as thus discovered, may have been young birds of late hatchings, not sufficiently strong to leave this country even at the latest period of migration. Attempts to rear the cuckoo have often been made, but hitherto unsuccessfully, as it never reaches to the succeeding spring. The natural food of the cuckoo consists of insects, particularly the hairy larvæ of some of the lepidopterous order; one of these it first kills, by passing it through the sharp *tomia*, or edges of its mandibles, it then adroitly cuts off the hinder end, and, by repeated jerks, frees the caterpillar of the intestinal canal, after which it swallows it whole.

Some naturalists assert that the well-known notes of the cuckoo are confined to the male, the female making only a chattering noise; but Mr. Blyth, in a paper in the 8th volume of 'Loudon's Magazine of Natural History,' says: "Both sexes, I believe, utter the call 'cuckoo'; and both, I know, repeat [on the wing] the other note, which I have designated 'full and melodious.' This is, indeed, in my opinion, one of the most musical sounds to be heard in the British woods, and closely resembles one or two notes in the nightingale's song, which are, however, inferior to it; it may be expressed, as nearly as writing can do it, by the monosyllable *cul*, or *cuil*, repeated several times in quick and continuous succession; and it is invariably uttered either immediately as the bird takes wing, or the moment before; sometimes the one, and sometimes the other. The common and more generally known note, *cuckoo*, is alike repeated either when perched or on the wing; and, I am fully confident in my own mind, by both sexes; but I will not speak quite positively on this point till I have myself examined a female which had been heard to sing. It is the decided opinion, however, of several observant persons of my acquaintance, for the accuracy of whose observations I have the highest regard, that this note is common to both sexes; and one even tells me that, as, with a gun in his hand, he was once talking to a friend, a cuckoo alighted upon a tree close by, and several times repeated its call; he was desired to shoot it, and did so; and, a day or two afterwards, his friend told him it was a pity he had shot it, for it had an egg almost ready to lay. I give this upon unquestionable authority. It is worthy of remark, also, that the note of the cuckoo is very much affected by the state of the weather. During a period of drought, it gradually becomes more and more hoarse, till at length the first syllable of it is often broken into two or three; but no sooner does a breeze arise from the south-west, than, before even a haze obscures the sky, it immediately softens, and is pronounced quite musically and distinct."

In Europe we possess but one species of the cuckoo. In Africa there is a remarkable species, called the *Honey-guide cuckoo*, or *Indicator*.—Its colour is rusty gray, and white beneath; the eyelids are naked, black; shoulders with a yellow spot; the tail is wedged, rusty; the bill is brown at the base, and surrounded with bristles, yellow at the tip; feathers of the thighs white, with a longitudinal black streak; the quill feathers above brown, beneath gray brown; first tail-feathers very narrow, and rusty; the next sooty, the inner edge whitish; the rest brown at the tip on the inner web. The honey-guide cuckoo inhabits the interior parts of Africa; is six inches long; is fond of honey; and not being able to procure it from the hollows of trees, by its note it is said to point it out to the inhabitants, who leave it a part for its services, and so highly value it on this account that it is criminal to destroy it.

Professor Sparmann has given us the following re-

markable account of the honey-cuckoo, which he first saw at the Cape of Good Hope. "This bird has nothing striking either in his size or colour. On a superficial view he appears very like the common gray sparrow, though he is somewhat larger, and has more of a yellow tinge; he has also a small yellow spot on each shoulder, and the feathers of his tail are streaked with white. Properly speaking, it is merely self-interest that induces him to show men where bees' nests are situated. For honey and bees' eggs are his favourite food; and he knows, that in plundering bees' nests a part is always lost, which will then fall to his share, or that a portion will be expressly allotted him as a reward for his services. Nevertheless, the manner in which this bird executes his design is very remarkable. The morning and evening seem to be his principal meal-times; at least it is then that he chiefly endeavours to attract the attention of men with his shrill voice. They then approach the bird, who, continuing his cry, flies on towards the place where the swarm of bees is to be found. They follow him, taking care not to make him too shy, either by much noise or by too numerous an assemblage of people; but answer from time to time with a very low whistle, to give him to understand that they are following him. I have observed," says M. Sparmann, "that when the bees' nest was still at a greater distance, the bird never halted till after a long flight, and then did it only in order to let the bee-hunters come up with him, and to solicit them anew to proceed; but as he came nearer to the nest, he always flew shorter distances at a time, and repeated his cry with greater earnestness and frequency. When he has at length arrived at the nest, whether it be situated in the cleft of a rock, or in a hollow tree, or under the ground, he hovers for some moments over it, and then takes his station in a neighbouring tree or bush, so that he cannot be seen by the men. They are always sure that they are near to a bees' nest when the bird is quite silent. When they have discovered and taken the bees' nest, under the direction of the bird, they generally reward him by leaving for him a considerable part of the bad combs, which contain the grubs, and of which he seems to be particularly fond."

The *Sacred cuckoo* is distinguished for the compass and melody of its voice. It is held in great veneration throughout the Indian peninsula. Insects are its usual food.

CHAP. VII.

OF THE PARROT, AND ITS AFFINITIES.

THE Parrot is the best known among us of all foreign birds, as it unites the greatest beauty with the greatest docility. Its voice also is more like a man's than that of any other; the raven is too hoarse, and the jay and magpie too shrill, to resemble the truth; the parrot's note is of the true pitch, and capable of a number of modulations that even some of our orators might wish in vain to imitate.

The ease with which this bird is taught to speak, and the great number of words which it is capable of repeating, are no less surprising. We are assured by a grave writer, that one of these was taught to repeat a whole sonnet from Petrarch; and that I may not be wanting in my instance, I have seen a parrot belonging to a

distiller who had suffered pretty largely in his circumstances from an informer who lived opposite him, very ridiculously employed. This bird was taught to pronounce the ninth commandment, *Thou shalt not bear false witness against thy neighbour*, with a very clear, loud, articulate voice. The bird was generally placed in its cage over against the informer's house, and delighted the whole neighbourhood with its persevering exhortations.

Willoughby tells a story of a parrot, which is not so dull as those usually brought up when this bird's facility of talking happens to be the subject. "A parrot belonging to King Henry VII., who then resided at Westminster, in his palace by the river Thames, had learned to talk many words from the passengers as they happened to take the water. One day, sporting on its perch, the poor bird fell into the water, at the same time crying out, as loud as he could, '*A boat! twenty pounds for a boat!*' A waterman, who happened to be near, hearing the cry, made to the place where the parrot was floating, and taking him up, restored him to the king. As it seems the bird was a favourite, the man insisted that he ought to have a reward rather equal to his services than his trouble: and, as the parrot had cried twenty pounds, he said the king was bound in honour to grant it. The king at last agreed to leave it to the parrot's own determination, which the bird hearing, cried out, '*Give the knave a groat!*'"

The parrot, which is so common as a foreign bird with us, is equally so as an indigenous bird in the climates where it is produced. The forests swarm with them; and the rook is not better known with us than the parrot in almost every part of the East and West Indies. It is in vain that our naturalists have attempted to arrange the various species of this bird; new varieties daily offer to puzzle the system-maker, or to demonstrate the narrowness of his catalogues. Linnæus makes the number of its varieties amount to forty-seven; while Brisson doubles the number, and extends his catalogue to ninety-five. Perhaps even this list might be increased, were every accidental change of colour to be considered as constituting a new species. But, in fact, natural history gains little by these discoveries; and as its dominions are extended it becomes more barren. It is asserted by sensible travellers, that the natives of Brazil can change the colour of a parrot's plumage by art. If this be true, and I am apt to believe the information, they can make new species at pleasure, and thus cut out endless work for our nomenclators at home.

Those who usually bring these birds over are content to make three or four distinctions, to which they give names; and with these distinctions I will content myself also. The large kind, which are of the size of a raven, are called *macaws*; the next size are simply called *parrots*.

those which are entirely white, are called *lories*; and the lesser size of all are called *parakeets*. The difference between even these is rather in size than any other peculiar conformation, as they are all formed alike, having toes, two before and two behind, for climbing and holding; strong hooked bills for breaking open nuts and other hard substances, on which they feed; and loud harsh voices, by which they fill their native woods with clamour.

But there are further peculiarities in their conformation; and first, their toes are contrived in a singular manner, which appears when they walk or climb, and when they are eating. For the first purpose they stretch two of their toes forward, and two backward; but when they take their meat, and bring it to their mouths with their foot, they dexterously and nimbly turn the greater hind-toe forward, so as to take a firmer grasp of the nut or the fruit they are going to feed on, standing all the while upon the other leg. Nor even do they present their food in the usual manner; for other animals turn their meat inwards to the mouth; but these, in a seemingly awkward position, turn their meat outwards, and thus hold the hardest nuts, as if in one hand, till with their bills they break the shell, and extract the kernel.

The bill is fashioned with still greater peculiarities; for the upper chap, as well as the lower, are both moveable. In most other birds the upper chap is connected, and makes but one piece with the skull; but in these, and in one or two species of the feathered tribe more, the upper chap is connected to the bone of the head by a strong membrane, placed on each side, that lifts and depresses it at pleasure. By this contrivance they can open their bills the wider; which is not a little useful, as the upper chap is so hooked and so overhanging, that, if the lower chap only had motion, they could scarcely gape sufficiently to take anything in for their nourishment.

Such are the uses of the beak and the toes, when used separately; but they are often employed both together, when the bird is exercised in climbing. As these birds cannot readily hop from bough to bough, their legs not being adapted for that purpose, they use both the beak and the feet; first catching hold with the beak, as if with a hook, then drawing up the legs and fastening them, then advancing the head and beak again, and so putting forward the body and feet alternately, till they attain the height they aspire to.

The tongue of this bird somewhat resembles that of a man; for which reason some pretend that it is so well qualified to imitate the human speech; but the organs by which these sounds are articulated lie farther down in the throat, being performed by the great motion which the *os hyoides* has in these birds above others.

The parrot, though common enough in Eu-

rope, will not, however, breed here. The climate is too cold for its warm constitution; and though it bears our winter when arrived at maturity, yet it always seems sensible of its rigour, and loses both its spirit and appetite during the colder part of the season. It then becomes torpid and inactive, and seems quite changed from that bustling loquacious animal which it appeared in its native forest, where it is almost ever upon the wing. Notwithstanding, the parrot lives even with us a considerable time, if it be properly attended to; and indeed, it must be owned, that it employs but too great a part of some people's attention.

The extreme sagacity and docility of the bird may plead as the best excuse for those who spend whole hours in teaching their parrots to speak; and, indeed, the bird, on these occasions, seems the wisest animal of the two. It at first obstinately resists all instruction; but seems to be won by perseverance, makes a few attempts to imitate the first sounds, and when it has got one word distinct, all the succeeding come with greater facility. The bird generally learns most in those families where the master or mistress have least to do; and becomes more expert, in proportion as its instructors are idly assiduous. In going through the towns of France some time since I could not help observing how much plainer their parrots spoke than ours, and how very distinctly I understood their parrots speak French, when I could not understand our own, though they spoke my native language. I was at first for ascribing it to the different qualities of the two languages, and was for entering into an elaborate discussion on the vowels and consonants; but a friend that was with me solved the difficulty at once, by assuring me that the French women scarcely did anything else the whole day than sit and instruct their feathered pupils; and that the birds were thus distinct in their lessons in consequence of continual schooling.

The parrots of France are certainly very expert, but nothing to those of the Brazils, where the education of a parrot is considered as a very serious affair. The history of Prince Maurice's parrot, given us by Mr. Locke, is too well known to be repeated here; but Clusius assures us that the parrots of that country are the most sensible and cunning of all animals not endued with reason. The great parrot, called the *aicurous*, the head of which is adorned with yellow, red, and violet, the body green, the ends of the wings red, the feathers of the tail long and yellow; this bird, he asserts, which is seldom brought into Europe, is a prodigy of understanding. "A certain Brazilian woman, that lived in a village two miles distant from the island on which we resided, had a parrot of this kind which was the wonder of the place. It seemed endued with such understanding as to discern and comprehend whatever she said to it. As we sometimes used to pass by that woman's house, she used to

call upon us to stop, promising, if we gave her a comb, or a looking-glass, that she would make her parrot sing and dance to entertain us. If we agreed to her request, as soon as she had pronounced some words to the bird, it began not only to leap and skip on the perch on which it stood, but also to talk and to whistle, and imitate the shoutings and exclamations of the Brazilians when they prepare for battle. In brief, when it came into the woman's head to bid it sing, it sang; to dance, it danced. But if, contrary to our promise, we refused to give the woman the little present agreed on, the parrot seemed to sympathize in her resentment, and was silent and immovable; neither could we, by any means, provoke it to move either foot or tongue."

This sagacity, which parrots show in a domestic state, seems also natural to them in their native residence among the woods. They live together in flocks, and mutually assist each other against other animals, either by their courage or their notes of warning. They generally breed in hollow trees, where they make a round hole, and do not line their nests within. If they find any part of a tree beginning to rot from the breaking off of a branch, or any such accident, this they take care to scoop, and to make the hole sufficiently wide and convenient; but it sometimes happens that they are content with the hole which a woodpecker has wrought out with greater ease before them; and in this they prepare to hatch and bring up their young.

They lay two or three eggs; and probably the smaller kind may lay more; for it is a rule that universally holds through nature, that the smallest animals are always the most prolific; for being, from their natural weakness, more subject to devastation, Nature finds it necessary to replenish the species by superior fecundity. In general, however, the number of their eggs is stinted to two, like those of the pigeon, and they are about the same size. They are always marked with little specks, like those of a partridge; and some travellers assure us, that they are always found in the trunks of the tallest, straightest, and the largest trees. The natives of those countries, who have little else to do, are very assiduous in spying out the places where the parrot is seen to nestle, and generally come with great joy to inform the Europeans, if there be any, of the discovery. As those birds have always the greatest docility that are taken young, such a nest is often considered as worth taking some trouble to be possessed of; and, for this purpose, the usual method of coming at the young is by cutting down the tree. In the fall of the tree it often happens that the young parrots are killed; but if one of them survives the shock, it is considered as a sufficient recompense.

Such is the avidity with which these birds are sought when young; for it is known they always speak best when their ear has not been antici-

pated by the harsh notes of the wild ones. But as the natives are not able upon all occasions to supply the demand for young ones, they are contented to take the old; and for that purpose shoot them in the woods with heavy arrows, headed with cotton, which knock down the bird without killing it. The parrots thus stunned are carried home; some die, but others recover, and, by kind usage and plentiful food, become talkative and noisy.

But it is not for the sake of their conversation alone that the parrot is sought after among the savages; for though some of them are but tough and ill-tasted, yet there are other sorts, particularly of the small parakeet tribe, that are very delicate food. In general it obtains, that whatever fruit or grain these birds mostly feed upon, their flesh partakes of the flavour, and becomes good or ill tasted, according to the quality of their particular diet. When the guava is ripe, they are at that season fat and tender; if they feed upon the seed of the acajou, their flesh contracts an agreeable flavour of garlic; if they feed upon the seed of the spicy trees, their flesh then tastes of cloves and cinnamon; while, on the contrary, it is insupportably bitter if the berries they feed on are of that quality. The seed of the cotton-tree intoxicates them in the same manner as wine does man; and even wine itself is drunk by parrots, as Aristotle assures us, by which they are thus rendered more talkative and amusing. But of all food, they are fondest of the carthamus, or bastard-saffron; which though strongly purgative to man, agrees perfectly with their constitution, and fattens them in a very short time.

Of the parakeet kind in Brazil, Labat assures us, that they are the most beautiful in their plumage, and the most talkative birds in nature. They are very tame, and appear fond of mankind; they seem pleased with holding parley with him; they never have done; but while he continues to talk, answer him, and appear resolved to have the last word: but they are possessed of another quality, which is sufficient to put an end to this association; their flesh is the most delicate imaginable, and highly esteemed by those who are fonder of indulging their appetites than their ears. The fowler walks into the woods, where they keep in abundance, but as they are green, and exactly the colour of the leaves among which they sit, he only hears their prattle, without being able to see a single bird; he looks round him, sensible that his game is within gunshot in abundance, but is mortified to the last degree that it is impossible to see them. Unfortunately for these little animals, they are restless, and ever on the wing, so that in flying from one tree to another, he has but too frequent opportunities of destroying them; for as soon as they have stripped the tree on which they sat of all its berries, some one of them flies off to another; and if that be found

fit for the purpose, it gives a loud call, which all the rest resort to. That is the opportunity the fowler has long been waiting for; he fires in among the flock, while they are yet on the wing; and he seldom fails of bringing down part of them. But it is singular enough to see them when they find their companions fallen. They set up a loud outcry, as if they were chiding their destroyer, and do not cease till they see him preparing for a second charge.

But though there are so many motives for destroying these beautiful birds, they are in very great plenty; and in some countries on the coast of Guinea, they are considered by the negroes as their greatest tormentors. The flocks of parrots persecute them with their unceasing screaming, and devour whatever fruits they attempt to produce by art in their little gardens. In other places they are not so destructive, but sufficiently common; and, indeed, there is scarce a country of the tropical climates that has not many of the common kinds, as well as some peculiarly its own. Travellers have counted more than a hundred different kinds on the continent of Africa only: there is one country in particular, north of the Cape of Good Hope, which takes its name from the multitude of parrots which are seen in its woods. There are white parrots seen in the burning regions of Ethiopia; in the East Indies they are of the largest size; in South America they are docile and talkative; in all the islands of the Pacific sea and the Indian ocean, they swarm in great variety and abundance, and add to the splendour of those woods which Nature has dressed in eternal green.

So generally are these birds known at present, and so great is their variety, that nothing seems more extraordinary than that there was but one sort of them known among the ancients, and that at a time when they pretended to be masters of the world. If nothing else could serve to show the vanity of a Roman's boast, the parrot-tribe might be an instance, of which there are a hundred kinds now known; not one of which naturally breeds in the countries that acknowledged the Roman power. The green parrakeet, with a red neck, was the first of this kind that was brought into Europe, and the only one that was known to the ancients, from the time of Alexander the Great to the age of Nero: this was brought from India; and when afterwards the Romans began to seek and rumage through all their dominions, for new and unheard-of luxuries, they at last found out others in Gaganda, an island of Ethiopia, which they considered as an extraordinary discovery.

Parrots have usually the same disorders with other birds: and they have one or two peculiar to their kind. They are sometimes struck by a kind of apoplectic blow,¹ by which they fall from

their perches, and for a while seem ready to expire. The other is the growing of the beak, which becomes so very much hooked as to deprive them of the power of eating. These infirmities, however, do not hinder them from being long-lived; for a parrot, well kept, will live five or six and twenty years.

SUPPLEMENTARY NOTE.

The Greeks seem at first to have known only one species of parrot, which was imported from the east by one of the captains of Alexander's fleet. Aristotle, the father of naturalists, speaks of it as a rare bird, of which he had heard by report. The beauty of parrots, and their faculty of speech, soon made them objects of high request among the luxurious Romans, whom the virtuous Cato justly reproaches for this puerile attachment. In his time, they kept them in cages of silver and ivory, and bought them at a price as high as that of a slave. The Portuguese who first doubled the Cape of Good Hope, found the whole coasts of Africa and the islands of the Indian ocean peopled with various tribes of parrots, totally unknown in Europe, and in such vast numbers that it was with difficulty they could be prevented from devouring the rice and maize. These, however, were far inferior to the numbers and variety that presented themselves to the first adventurers in the new world. Some of the islands there were called the Parrot Isles, from the vast quantity of these birds that flocked upon them. They constituted the first articles of commerce between the inhabitants of the old and new continents. In those regions every forest swarmed with them, and the rook is not better known in Europe than was the parrot in the East and West Indies. So great is their variety, that nothing seems more remarkable than that only one species should have been known to the ancients at a period when they boasted of being masters of the whole world. The geographical distribution of this tribe of birds is probably more extensive than is usually supposed. A species called the Carolina parrot, inhabits Guiana, and migrates into Carolina and Virginia in autumn; feeds on corn and kernels of fruit, particularly those of cypress and apples; comes into Carolina and Georgia in vast flights, doing great damage in orchards, by tearing in pieces the fruits for the sake of the seeds, the only part agreeable to its palate. It has been known to breed in Carolina, but the greater part retire south in breeding time, and return when the fruits are ripe. Mr. Abbot says it is called in Georgia the Parrakeet. Bartram observes, that it never reaches so far north as Pennsylvania, which is singular, as it is a bird of very rapid flight, and could easily perform the journey in 10 or 12 hours from North Carolina, which abounds in all those fruits in which it delights. Another species (by some supposed to be only a variety of the preceding) called the Illinois parrot, migrates from South America far northward, being common on the banks of the Ohio, and the southern shores of Lake Erie. They fly in flocks, and feed, among other things, on chestnuts, acorns, and wild pease. A third species, called the Emerald Parrot, is also an inhabitant of a comparatively cold climate. It is said to occur in the neighbourhood of the Straits of Magellan. Of this, however, Buffon has expressed great doubt, for he asserts, that no parrot is met with in so high a latitude. In this opinion he was perhaps guided by the general belief of their living on fruits and succulent food only, and the strength of his objection must therefore cease, when it is known that several of the genus feed on seeds and berries. Latham thinks the fact of their pretty extensive geographical distribution has been now

¹ Bleeding in the foot is recommended as a remedy for this. The aras or macaws are chiefly subject to this disease.—Ed.

asserted by too many authors of veracity to admit of doubt. We are told that two sorts were seen about Trinity Harbour in the South Seas, Lat. $41^{\circ} 7'$. Dr. Forster met with two kinds at Dusky Bay, New Zealand, Lat. 46° south, and large flocks as low as Port Famine, in the Straits of Magellan, Lat. $53^{\circ} 44'$ south, where their food must have been buds and berries, the forests being frequently bounded by mountains covered with eternal snow. Buffon confines parrots within 25 degrees on each side of the equator; but the preceding extracts clearly demonstrate the fallacy of such opinion. This numerous and splendid genus contains nearly 250 species.

It would be quite a hopeless task to attempt to enumerate the species and varieties of the parrot tribe. Buffon divided the parrots,—first, into parrots of the Old continent; second, into parrots of the New. The first are subdivided thus:

1. *Cockatoos*, with short and square tail, and mobile tuft.

2. *Parrots* proper, short and equal tail, and head destitute of tuft.

3. *Lories*, with small bill, curved and sharp: red the predominant colour in the plumage; voice, sharp; and motion, quick. Some, or the lories properly so called, have the tail moderately long, and rather angular, or corner like. Others, the lory-parakeets, have the tail longer, and more resembling that of the parakeets.

4. *Parakeets*, with long tails subdivided into those which have the tail equally graduated, and those which have the two intermediate quills much longer than the others.

5. *Parakeets*, with short tails.

The second subdivision is composed of—

1. *Aras* or *Maccaes*, with long graduated tails, and naked cheeks.

2. *Amazons*, with tail short and equal; green plumage; red on the carpus of the wing, and yellow on the head.

3. *Crieks*, like the preceding, but without the red, having it only on the coverts; plumage, duller green, without the pure yellow on the head, and of smaller size.

4. *Papegais* (for which perhaps the word *popinjay* may be admitted as a translation), smaller than the crieks, and without red on the wing.

5. *Parakeets* (*perruches*), subdivided into long-tailed and short.

Dr. Latham has simplified this division, and distinguishes but two groups, without respect to the habitat; for, as he well observes, the uncertainty of the country of many of those birds renders such a division inconvenient. He divides the parrots into—first, those with equal; second, those with unequal tails.

Le Vaillant has in some measure modified the classification of Buffon, without taking the habitat into consideration. He acknowledges the groups of aras and cockatoos, with the characters above cited; he unites the parrots, the amazons, the crieks, and papegais, under the general denomination of parrots (*perroquets*). He places in the division of parakeets (*perruches*), all that have graduated tails, and feathered cheeks; but still subdivides it into four groups:—

1. Parakeet maccaes (*perruches-aras*), in which the circumference round the eye is naked.

2. Parakeets proper, with cheeks entirely feathered, tail more or less long, but equally graduated and always sharp.

3. Arrow-tailed parakeets (*perruches a queue en fleche*), in which the two intermediate quills are much the longest.

4. Parakeets with broad tails, whose quills are not attenuated towards the end, among which are arranged the greater portion of the lories of Buffon.

The parrots are eminently climbing birds, as the form, the arrangement, and the strength of their toes clearly evince. When they walk on the ground, it is with a slowness, which is owing to a vacillating motion of the body, occasioned by the shortness and separation of their feet, in which the base of sustentation is very wide. They frequently place the point or upper part of their bill on the ground, which thus serves them as a point of support. In climbing, its hooked form is still more useful to them; and often when they hold any object in this bill, they rest upon the branches by the under part of their lower mandible. When they descend, they sustain themselves by the upper. This is a common habit with the majority of the parrot tribe. Still, there are some species, which, having more elevated legs, toes less long and less crooked, can walk on the ground with tolerable swiftness, and which never perch. These have been formed by Illiger into a separate genus under the name of *pezoporus*. Others, again, have the tarsi short and flat, on which they rest in walking.

The wings of the parrots being generally short, and their bodies bulky, they have some difficulty in rising to a certain point of elevation. But that once attained, they fly very well, and often with much rapidity, and through a considerable extent of space. The majority confine themselves to lofty and thickly tufted woods, frequently on the borders of cultivated lands, the productions of which they plunder and destroy. Their ordinary mode of flight is from one branch to another; and it frequently happens, that they will not fly continuously, except when pursued. Many of them emigrate according to the season, and, in particular, the Carolina parrots. Such travel every year some hundreds of leagues, differing in this respect from the habits of the others; but they are comparatively few in number. The difficulty of flight, with many, is the cause of their restriction within narrow limits; and their concentration in certain islands, while they are not found in others, which border closely on the former. This is peculiarly the case in many of the island groups of Polynesia.

The food of the parrots consists principally of the pulps of fruits, such as those of the banana, the coffee-tree, the palm, the lemon, &c. They are especially fond of almonds. Some cockatoos of New Holland are said to live on roots, and the *pezopori* seek their aliment in herbs. In domestication the parrots, maccaes, parakeets, and cockatoos, show the same partiality for vegetable seeds, and, in general, are fed very well on hemp-seed, the skins or husks of which they detach with wonderful address. Some that receive bones to gnaw, are known to acquire a very determined taste for animal substances, but especially for the tendons, ligaments, and other less succulent parts. From feeding thus, some parrots contract the habit of plucking out their own feathers, that they may suck the stem; and this becomes so imperious a want with them, that they strip their bodies absolutely naked, not leaving a vestige of down wherever the bill can reach. They spare, however, the quills of the wings and tail, the plucking out of which would cause them too much pain. M. Desmarest mentions an instance of one of these birds belonging to M. Latreille, the body of which thus became as naked as that of a pullet plucked for roasting. This bird, notwithstanding, supported the rigour of two very severe winters, without the slightest alteration of health or appetite. M. Viellot observes, that this habit of depilation is produced, in many parrots, by an itching of the skin, and not in consequence of their being accustomed to eat animal substances.

Parrots drink little, but often, and do it raising up the head, but less strongly than other birds. The

major portion of them may be accustomed, in domestication, to drink wine, or, at all events, to eat bread which has been steeped in wine. They all use, with great dexterity, one of their feet, to carry their food to their bills, while they stand perched on the other. These birds sojourn much on the borders of streams and rivers, and in marshy places. They are fond of the water, and seem to take the greatest delight in bathing themselves, an operation which they perform several times a-day, when in a state of nature. When they have bathed, they shake their plumage, until the greater portion of the water is expelled, and then expose themselves to the sun, until their feathers are completely dried. In captivity, and even during the most rigorous seasons, they seek to bathe; and, at all events, plunge the head repeatedly into water. With the exception of the time of incubation, the parrots live in flocks, more or less numerous; go to sleep at the setting, and awake at the rising of the sun. In sleep, they turn the head upon the back. Their sleep is light; and it is not unfrequent to hear them utter some cries during the night. In a state of domestication, after they go to rest is said to be the most suitable time for repeating to them such words as they are intended to learn, because they then experience no distraction. Their life is very long; and the mean duration of it, among the parrots, properly so called, is calculated at forty years. Instances, however, have been known, of individuals which lived in a state of domestication ninety, and even a hundred years and more. The parakeets generally live about five-and-twenty years.

CHAP. VIII.

THE PIGEON, AND ITS VARIETIES.

THIS is one of the birds which, from its great fecundity, we have, in some measure, reclaimed from a state of nature, and taught to live in habits of dependence. Indeed, its fecundity seems to be increased by human cultivation; since those pigeons that live in a wild state, in the woods, are by no means so fruitful as those in our pigeon-houses nearer home. The power of increase in most birds depends upon the quantity of their food; and it is seen, in more than one instance, that man, by supplying food in plenty, and allowing the animal at the same time a proper share of freedom, has brought some of those kinds which are known to lay but once a-year, to become much more prolific.¹

¹ The following is extracted from a paper on the natural history of the vicinity of St. Petersburg, by Charles Drosier, published in 'The Naturalist' for February 1838. "The common dovecot pigeon swarms in the city and the country; it is esteemed sacred, and called 'God's Bird' by the Russians, from the circumstance of the Holy Spirit assuming that form when it descended upon our Saviour. To kill and eat it is considered an act of profanation. It is so tame and incautious in the city, that vehicles have been known to pass over it while engaged in picking up the scattered corn which falls in abundance from the carts. I have touched the back of one with a walking stick from a drosky, and could have killed it had I been so disposed. This bird is certainly a nuisance in the city; it perches upon the architraves and projections of buildings, marring their

The tame pigeon, and all its beautiful varieties, derive their origin from one species, the stock-dove only; the English name, implying its being the stock or stem from whence the other domestic kinds have been propagated.² This bird, in its natural state, is of a deep bluish ash-colour; the breast dashed with a fine changeable green and purple; its wings marked with two black bars; the back white, and the tail barred near the end with black. These are the colours of the pigeon in a state of nature; and from these simple tints has man by art propagated a variety that words cannot describe, nor even fancy suggest. However, Nature still perseveres in her great outline; and though the form, colour, and even the fecundity, of these birds, may be altered by art, yet their natural manners and inclinations continue still the same.³

beauty, and loads the places where it rests with immense collections of dung, and by its flight overhead it may happen that the symmetry and polish of a pedestrian exquisite's coat, or the bonnet, parasol, or cloak of some fashionable belle, may meet with the same fate that the outspread banquet of Æneas received from the Harpies on 'the shores of the Sophiades.' The English and Germans eat the pigeon; and for their tables they are preserved and sold in the market by the less scrupulous Russians. I had one day an opportunity of observing, myself, how the respect for the pigeon prevails amongst the lower orders. I shot six, away from the village, at one shot, and brought them home, with the intention of obtaining that master achievement of modern cookery, a pigeon-pie, which I have often thought must be the nearest approach to 'Ambrosia' we poor sons of earth have discovered; when I threw them on the table, a Russian servant who was near, after several ejaculations against my impiety and cruelty, —for they do not understand the respect with which the English treat their superiors in station,—snatched up one of the dead birds, and bursting into tears commenced kissing and fondling it; yet a few days afterwards she plucked them without displaying the least uneasiness, a thing characteristic of the people, who for the most part act from impulse."—ED.

² See Supplementary Note B, p. 116.

³ The birds of this genus—which contains more than one hundred species—possessing a wider geographical range than almost any other tribe of birds, are found in every quarter of the globe, from the southern boundary of ice, to the confines of the Arctic circle. The general structure of the bill and feet being in all exceedingly characteristic, they form a well-marked family; and though modern naturalists have separated them into several sections and sub-genera, yet they all have such an affinity of form, as not easily to be mistaken. Their sizes are exceedingly various. The gourd or crowned pigeon, the largest of the tribe, measures about twenty-eight inches in length; while the ground dove is not larger than a sparrow, being only six inches and a half from the furthest extremity of the bill to the point of the tail. The species with short and robust bill are found throughout the whole extent of Africa, in the islands of the Indian archipelago, in New Holland, and in the islands of the South sea. The common pigeons, with moderate bill, are the most generally extended through both continents. Those with slender bill and long legs are proper to the climates of the New World, of Africa, and of Asia, but are not found in Europe. Stephens, in his illustration of the Columbine families, thus characterizes the genuine

stock-dove, in its native woods differs from the ring-dove, a bird that has never been recorded,⁴ by its breeding in the holes of rocks and the hollows of trees. All other birds of the same kind build, like rooks, in the topmost branches of the forest, and choose their habitations as remote as possible from man. But this species soon takes to build in artificial cavities; and, from the temptation of a ready provision and numerous society, easily submits to the tyranny of man. Still, however, it preserves its native colour for several generations, and becomes more variegated only in proportion as it removes from the original simplicity of its colouring in the woods.

The dove-house pigeon, as is well known, breeds every month; but then it is necessary to supply it with food when the weather is severe, or the fields are covered with snow. Upon other occasions it may be left to provide for itself, and it generally repays the owner for its protection.⁵ The pigeon lays two white eggs, which most usually produce young ones of different sexes. For the laying of each egg, it is necessary to have a particular congress with the male; and the egg is usually deposited in the afternoon. When the

pigeon: "Beak middle-sized, nearly straight, compressed and bent; the upper mandible with a soft and tumid membrane at its base, in which the nostrils are situated. Feet divided, with three toes before and one behind. Wings short or middling. Tail equal, or wedged." The species included under *Vinago* are distinguished from pigeons, properly so called, by their solid and thick beak, very short tarsi, and a slight membrane connecting the bases of the toes. They reside in the deep tropical forests of the old continent, and subsist on fruits. The *Gourae*, again, are discriminated by their very slender beak, and long tarsi. Only four species of the common pigeons are found wild in this last part of the globe; from one of them, the *biset*, as is supposed, are descended all the various races which we find in a state of domestication. Pigeons are diurnal and quiet birds, living only on pulpy fruits, berries, and grains, and but very seldom on insects and snails. They are eminently monogamous. The male and female concur in the construction of the nest, and fix it, according to the species, sometimes on the summits of the largest trees, sometimes in the bushes, and even on the ground, and sometimes in the cavities of rocks. This nest, rather rudely composed of small branches and leaves, is very wide, and usually contains but two eggs, and sometimes four. In one species only of the gallinaceous pigeons, the female lays six or eight. The male and female sit on the eggs, alternately, or together. They have two or three broods in the year, and after the last, they quit the climates where they nestle, to migrate into more southern regions. There are at least very few exceptions to this fact. The borders of forests, and the neighbourhood of waters, appear to suit them best. As these birds do not digest the seeds of certain fruits, they propagate the vegetable species in their voyages by voiding the seeds with their excrements. It is thus that the multiplication of the nutmeg tree may be explained in the islands where no traces of it were to be found at no very remote era. —ED.

⁴ This is a mistake — See Note p. 115.

⁵ See Supplementary Note D, p. 119.

eggs are thus laid, the female in the space of fifteen days, not including the three days during which she is employed in laying, continues to hatch, relieved at intervals by the male. The turns are usually regulated with great exactness. From three or four o'clock in the evening till nine the next day, the female continues to sit; she is then relieved by the male, who takes his place from ten till three, while his mate is feeding abroad. In this manner they sit alternately till the young are excluded. If, during this term, the female delays to return at the expected time, the male follows, and drives her to the nest; and should he in his turn be dilatory, she retaliates with equal severity.

The young ones, when hatched, require no food for the first three days, only wanting to be kept warm, which is an employment the female takes entirely upon herself. During this period she never stirs out, except for a few minutes to take a little food. From this they are fed for eight or ten days with corn or grain of different kinds, which the old ones gather in the fields and keep treasured up in their crops, from whence they throw it up again into the mouths of their young ones, who very greedily demand it.

As this method of feeding the young from the crop is different in birds of the pigeon kind from all others, it demands a more detailed explanation. Of all birds, for its size, the pigeon has the largest crop, which is also made in a manner quite peculiar to the kind. In two of these that were dissected by a member of the Royal Academy of Sciences, it was found that if the anatomist blew air into the windpipe, it distended the crop or gullet to a prodigious size. This was the more extraordinary, as there seemed to be no communication whatever between these two receptacles; as the conduit by which we breathe, as every one knows, leads to a very different receptacle from that where we put our food. By what apertures the air blown into the lungs of the pigeon makes its way into the crop, is unknown; but nothing is more certain than that these birds have a power of filling the crop with air; and some of them, which are called *croppers*, distend it in such a manner, that the bird's breast seems bigger than its body. The peculiar mechanism of this part is not well known; but the necessity for it in these animals is pretty obvious. The pigeon, as we all know, lives entirely upon grain and water: these are mixed together in the crop; and in the ordinary way are digested in proportion as the bird lays in its provision. But to feed its young, which are very voracious, it is necessary to lay in a store greater than ordinary, and to give the food a kind of half maceration, to suit their tender appetites.⁶ The

⁶ At first they are fed with a substance resembling curd, secreted within the crop, the coating of which becomes thickened and enlarged. The process is somewhat analogous to the secretion of milk within the mammae of quadrupeds. If the state of the crop be ex-

heat of the bird's body, assisted by air, and numerous glands separating a milky fluid, are the most necessary instruments for this operation: but, in proportion as the food macerates, it begins to swell also; and the crop must, of consequence, be considerably dilated. Still, however, the air which is contained in it gives the bird a power of contracting it at pleasure; for if it were filled with more solid substances, the bird could have no power to compress it. But this is not the case; the bird can compress its crop at pleasure; and driving out the air, can thus drive out the food also, which is forced up the gullet like a pellet from a popgun. The young ones, open-mouthed, receive this tribute of affection, and are thus fed three times a-day. In feeding, the male usually supplies the young female, while the old female supplies the young of the opposite sex. The food with which they are supplied is more macerated at the beginning; but as they grow older, the parents give it less preparation, and at last drive them out to shift for themselves. When well-fed, however, the old ones do not wait for the total dismissal of their young; but in the same nest are to be found young ones almost fit for flight, and eggs hatching at the same time.

The fidelity of the turtle-dove is proverbial, and makes the usual comparison of such poets as are content to repeat what others have said before them; but the pigeon of the dove-house is not so faithful; and having been subjected to man, it puts on licentiousness among its other domestic habits. Two males are often seen quarrelling for the same mistress; and when the female admits the addresses of a new gallant, her old companion seems to bear the contempt with some marks of displeasure, abstaining from her company; or if he approaches, it is only to chastise her. There have been instances when two males, being displeased with their respective mates, have thought proper to make an exchange, and have lived in great harmony with their new companions.⁷

Examined during incubation, it will be found to have a glandular and irregular appearance. Upon killing an old pigeon, when the young are just protruding from the egg, it will be observed to have within this cavity small pieces of white curd mixed with its ordinary food of pease, barley, and other grains. It is for a short time that the young are fed with this substance; for, on the third day it is administered along with a mixture of common food, and in eight or nine days the secretion of curd completely fails in the old birds, from which time they are capable of ejecting common food alone. This singular disposition of Nature is very remarkable, and we cannot but admire the final cause by which the pigeon is assigned the power of casting up this curd alone, although other food be in the crop at the same time.—Ed.

⁷ This is a favourite bird with all those who love to wander among the woods in spring, and listen to their varied harmony. They will there hear many a singular and sprightly performer; but none so mournful as this. The hopeless wo of settled sorrow, swelling the heart of female innocence itself,

So great is the produce of this bird in its domestic state, that near fifteen thousand may, in the space of four years, be produced from a single pair. But the stock-dove seldom breeds above twice a-year; for when the winter months come, the whole employment of the fond couple is rather for self-preservation than transmitting a posterity. They seem, however, to have a stronger attachment to their young than those which are found to breed so often; whether it be that instinct acts more powerfully upon them in their state of nature, or that their affections are less divided by the multiplicity of claims.

It is from a species of these, therefore, that those pigeons which are called *carriers*, and are used to convey letters, are produced. These are easily distinguished from all others by their eyes, which are compassed about with a broad circle of naked white skin, and by being of a dark blue or blackish colour. It is from their attachment to their native place, and particularly where they have brought up their young, that these birds are employed in several countries as the most expeditious carriers. They are first brought from the place where they were bred, and whither it is intended to send them back with information. The letter is tied under the bird's wing, and it is then let loose to return. The little animal no sooner finds itself at liberty, than its passion for its native spot directs all its motions. It is seen, upon these occasions, flying directly into the clouds to an amazing height; and then, with the greatest certainty and exactness, directing itself, by some surprising instinct, towards home, which lies sometimes at many miles distance, bringing its message to those to whom it is directed. By what marks they discover the place, by what chart they are guided in the right way, is to us utterly unknown; certain it is, that in the space of an hour and a half they perform a journey of forty miles; which is a degree of despatch three times greater than the fleetest quadruped can perform. These birds are not brought up at present with as much care as formerly, when they were sent from governors in a besieged city to generals that were coming to relieve it with-

could not assume tones more sad, more tender and affecting. Its notes are four; the first is somewhat the highest, and preparatory, seeming to be uttered with an inspiration of the breath, as if the afflicted creature were just recovering its voice from the last convulsive sobs of distress; this is followed by three long, deep, and mournful moanings, that no person of sensibility can listen to without sympathy. A pause of a few minutes ensues, and again the solemn voice of sorrow is renewed as before. This is generally heard in the deepest shaded parts of the woods, frequently about noon and towards the evening. There is, however, nothing of real distress in all this; quite the reverse. The bird who utters it wanders by the side of his beloved partner, or invites her by his call to some favourite retired and shady retreat. It is the voice of love, of faithful connubial affection, for which the whole family of doves are so celebrated; and among them all, none more deservedly so than the species now before us.—Ed.

out; when they were sent from princes to their subjects with the tidings of some fortunate event; or from lovers to their mistresses with expressions of their passion. The only use we now see made of them is to be let fly at Tyburn, when the cart is drawn away: pretty much as when some ancient hero was to be interred, an eagle was let off from the funeral pile, to complete his apotheosis.⁸

The varieties of the tame pigeon are so numerous, that it would be a vain attempt to mention them: so much is the figure and colour of this bird under human control, that pigeon-fanciers, by coupling a male and female of different sorts,

⁸ In 1765, an experiment was made, by which the velocity and flight in these birds was pretty well ascertained. A gentleman, for a trifling wager, sent a carrier-pigeon from London by the coach, to a friend at St. Edmondsbury; and along with it a note, desiring that the pigeon, two days after its arrival there, might be thrown up precisely when the town clock struck nine in the morning. This was accordingly done; and the pigeon arrived in London, and flew into the Bell Inn in Bishopsgate-street, at half-an-hour past eleven o'clock of the same morning; having flown 72 miles in the space of two hours and a half. In 1803, another experiment was made, by which the pigeon was ascertained to perform a distance of 83 miles in three hours and seven minutes.

Some years ago this animal was made use of for a very extraordinary purpose. During the drawing of a lottery, a gang of sharpers, distributed in various places, devised a scheme for making this bird an instrument of their plunder. One of these was to bring with him a carrier-pigeon, and wait in the Guildhall till a large prize was drawn, and with all possible despatch to place the fortunate number under the wing of the pigeon, and let him loose. This intelligence was faithfully conveyed to his associate, in a much more speedy manner than by the usual mode, and he was directed to insure the number to whatever amount he thought proper. It is probable, that from this circumstance might arise the application of the common cant term *pigeon*, to any one who had been overreached and cheated.

On the 11th of July, 1819, thirty-two pigeons, with the word 'Antwerp' marked on their wings, and which had been reared in that city, and let loose in London at seven o'clock in the morning, after having their wings countermarked with the name of the British metropolis. The same day, at noon, one arrived at home, and obtained the first prize; a quarter of an hour after another arrived, and obtained the second prize. The following day twelve others arrived, making fourteen in all; what became of the others we are not told. Another experiment was made in July 1829, in consequence of wagers laid at Maestricht, between some merchants there, that pigeons taken to London, would, when loose, return in six hours. Forty-two pigeons were brought to London, and, after being properly marked, were thrown up at twenty-six minutes past eight in the morning. The principal wager was for ten thousand guilders, and would have been gained had any one of the birds arrived at Maestricht within six hours; but owing, as it was supposed, to heavy rain, the first did not arrive till six hours and a quarter from the time of leaving London, having nevertheless travelled at the rate of forty-five miles an hour. The second arrived in seven hours, the third in seven hours and ten minutes, the fourth in seven hours and a half, and in four days more than twenty had reached their place of destination.—Ed.

can breed them, as they express it, to a feather. From hence we have the various names of *croppers*, *carriers*, *jacobines*, *powders*, *runts*, *turbits*: all birds that at first might have accidentally varied from the stock-dove; and then, by having these varieties still heightened by food, climate, and pairing, different species have been produced.⁹

⁹ The following account of a pigeon, exhibiting in a very remarkable degree the social instinct misapplied, was transmitted to the editor of 'The Edinburgh Journal of Natural History' by the Rev. Mr. Adam of Peebles. "About fourteen years ago," says the owner of the bird, in a letter to the gentleman just mentioned, "the right wing of the pigeon which you saw in our house was broken by a shot, which was the means of his coming into our possession. After recovering of his wound, he showed his courage by defeating a hawk, who had the audacity to attack him, as he sat in the sole of a window. On one occasion he was sent with his mate—for we took care to furnish him with one—to the house of a gentleman in our neighbourhood; and while there, he gave many proofs of his superiority as a bird of courage, at least when opposed to others of his own species; and this superiority he maintained until his companion fell a prey to the rats. Poor Poodle (as we call him), disconsolate for the loss of his spouse, now left this place for his former habitation, no doubt thinking that a change of scene might do him good; but, unable to fly, he was obliged to walk a distance of somewhat more than a quarter of a mile. Way-worn and bedaubed with mud, he trudged into the room, and emitted his wonted *coo-roo* as he took possession of his old castle, to wit, that part of the floor in a corner, on which stands an old table, and into which he will not allow dog or cat to enter, or even to approach, without a blow of his wing or bill. Next spring, finding no mate, he attached himself to a stocking-foot stuffed with straw, round which he built a nest. The year following he took up with a rabbit that used to run about the house. This animal in its pranks, with a kind of half wicked and half sportive design, would sometimes destroy Poodle's nest. This was no doubt a great annoyance to the pigeon, for it generally cost him the labour of a whole week to repair the injury done. It was curious to see how he proceeded in this operation: having lifted a piece of twig, and placed it in the position in which he wished it to rest upon those intended to be placed under it, he perhaps found it too large, on which he would not attempt to shorten it, for some kind of intuitive knowledge seemed to assure him, that the attempt on his part would be vain; but laid aside the long twig for future use, and had recourse to one of smaller dimensions. While this rabbit was his associate, he used to remind it at night that it was time to retire to rest; if disobeyed, he gave the intimation in another form, went out from his retirement, and compelled compliance. During the day, if the rabbit was on the floor, he used to come out and attempt to decorate it, in which occupation he took great pleasure, especially in trimming its long ears. The rabbit would sit still all the while, unless the pigeon became rude, when a battle would take place. At length the rabbit was killed, and Poodle for some time had no mate; but thinking it better to have a partner of any sort than none at all, he attached himself to the dog, who allowed him to perch on his back, and use any liberty short of inflicting pain. He always, however, keeps possession of his castle, which the hens, the cat, and the dog, sometimes seem inclined to enter, but from which, though age has damped his fire, he succeeds in repelling them. Another curious circumstance is, that he seems fond of knowing all that is going on. If a

But there are many species of the wild pigeon, which, though bearing a strong affinity to the stock-dove, are, nevertheless, sufficiently different from it to deserve a distinct description.—The *ring-dove* is of this number; a good deal larger than the former; and building its nest with a few dry sticks, in the boughs of trees. This seems a bird much fonder of its native freedom than the former; and attempts have been frequently made to render it domestic, but they have hitherto proved fruitless;¹⁰ for though their eggs have been hatched by the tame pigeon in a dove-house, yet, as soon as they could fly, they always betook themselves to the woods where they were first produced. In the beginning of winter these assemble in great flocks in the woods, and leave off cooing; nor do they resume this note of courtship till the beginning of March, when the genial season, by supplying them with food, renews their desires.¹¹

person with whom he is acquainted calls, he is sure to regard him with very particular attention; and as a proof of his inquisitive disposition, it may be stated, that for some time there was a hole in the floor, at which he would place himself frequently remaining half-an-hour, and giving good heed to what was going on in the apartment beneath. Again, let it be supposed that he is sitting on the outside of the window, and that he perceives preparations going on for breakfast or dinner, he manifests great joy by half flying and half tumbling down to the ground, and makes his appearance by coming up stairs. If he be asleep in his castle at supper time, and any of the family say, 'Poodle, why don't you come for your share?' he replies in his own way, and presently comes forth."—ED.

¹⁰ It is stated in Dr. Fleming's 'History of British Animals,' that the *Columba palumbus*, or ring-dove of our woods, is easily tamed, but will not breed in confinement. Mr. John Robertson, of Rosehall gardens, Glasgow, had in his aviary a pair of these beautiful birds. A wooden box was put up in a corner of the aviary with the intention of giving the birds an opportunity to breed. The box, however, was not securely fixed, and fell from its position in a short time after, containing a nest and one egg, which was broken to pieces by the fall. The box again being secured, the cushats again built, and, pursuing the work of incubation, were successful in bringing out and rearing a pair of fine healthy young ones. At Prinlows House, near Leslie in Fife, a pair of ring-doves built and incubated on a spruce fir-tree, in a plantation which bounded a garden, about fifteen yards from the house. Their nest was not more than twenty-five feet from the ground, and close to a garden-walk through which the family were constantly passing. Yet this seemed to give the conubial pair no uneasiness, as the female would sit on her nest, with her mate at her side, without attempting to quit the spot on the approach even of several individuals. The first young, which they brought up in the following spring, built a nest in a spruce fir within the garden, and reared their young. Both these nests were occupied every season afterwards during several years. These birds very frequently alighted and fed in the garden, and even ate occasionally along with the domestic poultry; from which we are of opinion that, if unmolested, the cushat is not so shy a bird as is generally imagined, and that it is only from persecution that it retires to the deep recesses of woods for shelter from its numerous enemies.—ED.

¹¹ See Supplementary Note A.

The turtle-dove is a smaller, but a much shyer bird, than any of the former. It may easily be distinguished from the rest by the iris of the eye, which is of a fine yellow, and by a beautiful crimson circle that encompasses the eyelids. The fidelity of these birds is noted; and a pair being put in a cage, if one dies the other will not survive it. The turtle-dove is a bird of passage, and few or none remain in our northern climates in winter. They fly in flocks when they come to breed here in summer, and delight in open, mountainous, sandy countries. But they build their nests in the midst of woods, and choose the most retired situations for incubation. They feed upon all sorts of grain, but are fondest of millet-seed.

To this short list might be added a long catalogue of foreign pigeons, of which we know little more than the plumage and the names.¹² Indeed, the variety of their plumage is as beautiful as the names by which they are known are harsh and dissonant. The *ocotsimtzcan*, for instance, is one of the most splendid tenants of the Mexican forests; but few, I believe, would desire to learn the name, only to be informed that it is covered with purple, green, and yellow plumage. To describe such birds, the historian's pen is not half such a useful implement as the painter's pencil.

¹² See Supplementary Note C, p. 117.

NOTE A.—The Ringed Dove or Cushat.

The pigeons or doves form a very natural family, perfectly distinct from the gallinaceous birds, to which they exhibit little more affinity than is indicated by their very large crop, which, however, is of a different form, and their granivorous habits. They vary much in form, some having the body full, others slender, while the tail is very short, moderate, or greatly elongated. In all, however, the head is small, oblong, compressed, with the fore part rounded. The bill is especially characterized by having the nasal membrane bare, generally scurfy, fleshy, and tumid, with the narrow longitudinal nostrils placed under its anterior margin. It varies in size, but the upper mandible has its ridge always obliterated at the base, by the encroachment of the nasal membranes, and its extremity horny, arched or convex, more or less compressed, with a blunt thin-edged point. The oesophagus expands into a large crop, consisting as it were of two united membranous sacs; the stomach is a powerful gizzard, of a somewhat rhomboidal form: the intestine is long and slender; and the cæca are very small and cylindrical. The tarsi are generally short and stout, either scutellate or feathered; the foot is of that kind equally adapted for walking or perching, having three toes before, and one behind, the latter on the same level, and shorter than the lateral, the claws short, and moderately arched. The plumage is various, but the feathers have always the tube very short, and the shaft thick at the base. The wings are large, more or less pointed, and the tail is even, rounded, or graduated. Several genera, some of them founded on slight differences, have been instituted in this family. The four species which occur in Britain belong to the genus *Columba*, which may be characterized as follows: The bill rather short and slender, the upper mandible tumid and scurfy at the base

horny, arcuato-declinate, convex above, compressed, thin-edged towards the end; the wings long, broad, rather pointed, the second and third quills longest; the tail of moderate length, or rather long, straight, even, or slightly rounded, of twelve broad feathers.

The ringed dove, or cushat (*Columba palumbus*) is distinguished by having the plumage of the upper parts grayish blue; the wings and scapulars tinged with brown; the hind part and sides of the neck bright-green and purplish red, with two cream-coloured patches; the fore part of the neck and breast light reddish purple; a white patch on the wing, including the four outer secondary coverts. It is the largest of our native species, measuring about seventeen inches in length, and about thirty between the tips of the wings. It is a strong bird of its size, elegantly formed, and agreeably, although not gaudily, coloured. Its food consists of seeds of the cultivated cereal grasses, wheat, barley, and oats, as well as of leguminous plants, beans and pease, the field mustard and charlock, leaves of the turnip clover, and other plants, beech-nuts, acorns, and other vegetable substances. It is generally distributed, being found in all the more or less wooded districts of England and Scotland; but it prefers cultivated tracts, and is not found in the bare and treeless parts of the country. In winter it appears in large flocks, sometimes amounting to many hundreds, when the individuals of a district congregate in some favourable locality, although in ordinary circumstances it is not so decidedly gregarious as the rock-dove. Its flight is strong and rapid, being performed by quick beats of the half-extended wings, with occasional intermissions, its pinions sounding as it glides along. When it has espied a place likely to afford a supply of food, it alights abruptly, and usually stands for a short time to look about, after which it commences its search. It walks in the manner of the domestic pigeon, that is, with short and quick steps, moving its head gently backwards and forwards. The flock disperses and spreads over the field, it being seldom that two or three individuals keep close together, and they generally take care not to approach the enclosing walls or hedges, so that it is difficult to shoot them on the ground. In the time of snow or hard frost, they frequent turnip fields, and are more easily approached; but in general they are very suspicious and vigilant, ever ready to fly off, on the slightest appearance of danger. Frequently, however, in the woods, one may surprise them within shooting distance; and by waiting for their arrival at their roosting places in winter, considerable execution may occasionally be done among them. As the flesh of the pigeon affords a sufficiently palatable article of food, it is abundant in our markets in winter and spring, but generally brings a low price, from sixpence to a shilling.

Soon after sunset, the cushats betake themselves to their roosting places in the woods, and before settling, usually wheel round the spot selected. Should they be disturbed, they fly off to a short distance and return; but if repeatedly molested, they betake themselves to a distant station. In severe weather they sometimes perform partial migrations, but in general are stationary, not finding it necessary to extend their range in the cultivated and sheltered districts, where turnips may always be had during the winter. In fine weather they bask in the sun on dry banks, or in the open fields, rubbing themselves, and as it were burrowing, in the sand or soil, and throwing it about with their wings, as if washing in water, which they do like most birds. In drinking, they immerse the bill to the base, and take a long draught; a circumstance in which pigeons differ from gallinaceous birds. Nor does the cushat, like them, scrape up the earth with its feet, while searching for food. Early in spring the cushats make

preparations for rearing their young. Their courtship is conducted much in the same manner as that of the domestic pigeon, the male strutting with elevated head, protruded breast, and quick step, round the female, or, if on a branch, performing various movements and often turning round, as he utters his murmuring love-notes. At times he rises in the air, produces a smart noise by striking the points of his wings against each other, descends, rises again, and thus continues to gambol in the presence of his mate. The cooing of this species may be imitated by pronouncing the syllables *coo-roo-coo-coo*, the too last protracted. It is softer, deeper, and more plaintive than that of the rock-dove.

The nests are placed on a branch, or in the fork of an oak, beech, fir, or other suitable tree, more especially a fir or pine; and in the latter case, often only a few feet from the ground. Sometimes a nest may be seen in a holly or hawthorn bush, or in a hedge, but in general a thick wood is preferred. It is composed of twigs loosely put together, in a circular form, flat above, and varying in thickness from two to four inches. The eggs are always two, of a regular oval or sometimes elliptical form, pure white, an inch and seven-twelfths in length. It appears that two or even three broods are reared in the year. The young are at first rather scantily covered with a yellowish down, and when fledged are of the same colour as the adult, but duller and tinged with brown, the white spots on the neck and the changing tints of that part being wanting. The colours are perfected at the first moult, the only change that they afterwards undergo being to a somewhat deeper and purer tint.

The ringed dove is generally distributed over Europe, but is more abundant in the southern parts.

NOTE B.—The Rock-dove.

The rock-dove is the original of our domestic pigeons, and is of frequent occurrence on many of our rocky coasts. The plumage of this species is light grayish-blue, the lower parts being as deeply coloured as the upper. The middle of the neck all round is splendid with green, its lower part with purplish-red. The back and the upper part of the sides, from near the shoulders to near the tail, are pure white, as are the lower wing-coverts and axillaries. The primaries and their coverts are brownish-gray on the outer web, the former dusky towards the end, as are the outer secondaries. There are two broad bars of black on the wing, one extending over the six inner secondary quills, the other over the secondary coverts, the outer two excepted. The tail has a broad terminal band of black, and the outer web of the lateral feathers is white. The downy part of the feathers is grayish-white, excepting on the white part of the back, where it is pure white. The horny part of the bill is brownish-black, as is the anterior half of its tumid portion, of which the rest is white; the iris is bright yellowish-red; the bare space around the eye flesh-coloured; the tarsi and toes carmine-purple; the claws grayish-black. The length is fourteen inches, and the extended wings measure twenty-seven. The female is a little smaller, and has the shining colours on the neck less extended.

This beautiful bird occurs in great abundance in the outer Hebrides, in Skye, Mull, and other islands on the north-west coast of Scotland, in Shetland, and Orkney, and here and there along the rocky shores of all parts of the northern division of Britain, as well as on some of the southern. At early dawn, the pigeons may be seen issuing from their retreats in straggling parties, which soon take a determinate direction, and meeting with others by the way, proceed in a loose body along the shores until they

reach the cultivated parts of the country, where they settle in large flocks, diligently seeking for grains of barley and oats, pods of the charlock, seeds of the wild mustard, polygona, and other plants, together with several species of small shell-snails, which abound in the sandy pastures. When they have young, they necessarily make several trips in the course of the day, but from the end of autumn to the beginning of summer, they continue all day in the fields. In winter they collect into flocks, sometimes composed of several hundred individuals; and, as at this season they are anxious to make the best use of the short period of day-light, they may easily be approached by a person acquainted with the useful art of creeping and skulking. In general, however, they are rather shy, and very seldom allow a person to advance openly within sixty or seventy yards. After the corn has ripened they soon become plump, and continue in good condition until the middle of winter, or even later should the season prove mild; but in spring and summer they are lean and tough. Their flesh is superior to that of the wood pigeon, but not equal to that of the golden plover, a bird which is equally abundant in the northern and western islands.

The manners of the rock-doves are similar to those of our domestic pigeons. When searching for food, they walk about with great celerity, moving the head backwards and forwards very prettily at each step. In windy weather, they usually move in a direction more or less opposite to the blast, and keep their body nearer to the ground than when it is calm, the whole flock going together. When startled, they rise suddenly, and by striking the ground with their wings produce a crackling noise. Their flight is very similar to that of the ringed and golden plovers, birds which in form approach very nearly to the pigeons; when at full speed, they fly with great celerity, the air whistling against their pinions. They usually alight abruptly when the place is open and clear, and if very hungry immediately commence their search; but on other occasions they fly over the field in circles, gradually descend, and on alighting stand and look round them for a few moments. The notes of this species resemble the syllables coo-coo, quickly repeated, the last prolonged. Its nuptials are celebrated with much cooing and circumambulation on the part of the male, and the first eggs are laid as early as the beginning of April, several broods being reared in the season. The nest is rudely constructed of straws, grass, various other plants, and frequently a few feathers; the eggs, like those of all other pigeons, are two in number, smooth, and pure white. The young, which are at first covered with loose yellow down, are fed by their parents, who, applying their bill to that of the nestlings, force up the food from their crops, so as to be within reach of the bill of the young, which all the while flaps its wings, and utters a low cheeping note, indicative of its eagerness to have its wants supplied. When fledged, they are of the same colour as the old birds, the head and neck, however, being of a dull purplish-blue, without the bright green and purple tints of the old, and the wings tinged with brown. At the first moult they acquire their full colour.

In Shetland, according to the Rev. Mr. James Barclay, they are met with in considerable numbers, and are especially abundant in the parishes of Sandwick and Dunrossness, as well as in Fetlar, these places being the most extensively cultivated. They flock twice in the year, first in August or September, and again in winter. One pair when tamed generally breed four times in the season; and so great is their fecundity, that they are frequently seen sitting on eggs long before the former brood is able to leave the nest, so that the parent bird has at the same time

young birds and eggs to take care of. Mr. Smith, of the same country, states that in Fetlar they are seen in large flocks in the winter and spring months, when they frequent barn-yards, especially should the ground be covered with snow. The crops of Mr. Smith's specimens were completely filled up to the mouth: that of one with a mixture of barley and oats, together with a considerable number of eggs of snails, and some fragments of the pods of charlock; that of another, with oats, a few seeds of polygona, and fragments of charlock; and that of the third with oats alone. The number of oat seeds in the crop of the second amounted to 1000 and odds, and the barley seeds in that of a specimen sent by Mr. Barclay were 510. From these facts it may be imagined what a quantity of seeds is annually devoured by all the pigeons, wild and tame, in Britain.

After a long continuance of snow, these birds become extremely emaciated, for they scarcely find any thing to eat on the shores, and they do not appear to betake themselves to turnip fields, like the wood pigeons. Indeed, in most of the districts in which they abound, turnips are very rarely cultivated. From ten to twenty have sometimes been killed at a shot, when they have settled on corn-stacks, and it is not uncommon to obtain as many as four or five even on stubble or newly sown fields, for they often move very close together. The peregrine falcon and the sparrow-hawk seem to be the only feathered enemies of this species, whose power of flight, however, is such as to render it little liable to persecution even from them, while its rocky haunts exempt it from the attacks of rapacious quadrupeds. It is easily tamed when procured from the nest, and readily breeds with the domestic pigeon. On the other hand, individuals of the latter often fly off to the rocks, and either form colonies apart, or mingle with the wild pigeons. In its truly wild state, the rock-dove presents no remarkable variations of colour, and the variously coloured individuals sometimes seen among the rocks are emancipated slaves, or their descendants.

Another British species, the stock-dove, is very similar to the present, but differs in having no white on the rump, and in its habits and distribution, it being entirely unknown in the northern parts of the country.

NOTE C.—*The Migratory Pigeon of North America.*

Of the migratory or wild pigeon of North America Wilson gives the following extraordinary account:—

"The most remarkable characteristic of these birds," he says, "is their associating together, both in their migrations, and also during the period of incubation, in such prodigious numbers, as almost to surpass belief; and which has no parallel among any other of the feathered tribes, on the face of the earth, with which naturalists are acquainted. These migrations appear to be undertaken rather in quest of food, than merely to avoid the cold of the climate; since we find them lingering in the northern regions, around Hudson's Bay, so late as December; and, since their appearance is so casual and irregular, sometimes not visiting certain districts for several years in any considerable numbers, while at other times they are innumerable. I have witnessed these migrations in the Genesee country, often in Pennsylvania, and also in various parts of Virginia, with amazement; but all that I had then seen of them were mere straggling parties, when compared with the congregated millions which I have since beheld in our western forests, in the States of Ohio, Kentucky, and the Indiana territory. These fertile and extensive regions abound with the nutritious beech nut, which constitutes the chief food of the wild pigeon. In seasons when these nuts are abun-

dant, corresponding multitudes of pigeons may be confidently expected. It sometimes happens that, having consumed the whole produce of the beech trees, in an extensive district, they discover another, at the distance perhaps of sixty or eighty miles, to which they regularly repair every morning, and return as regularly in the course of the day, or in the evening, to their place of general rendezvous, or as it is usually called, the roosting place. These roosting places are always in the woods, and sometimes occupy a large extent of forest. When they have frequented one of these places for some time, the appearance it exhibits is surprising. The ground is covered to the depth of several inches with their dung; all the tender grass and underwood destroyed; the surface strewn with large limbs of trees, broken down by the weight of the birds clustering one above another: and the trees themselves, for thousands of acres, killed as completely as if girdled with an axe. The marks of this desolation remain for many years on the spot; and numerous places could be pointed out, where, for several years after, scarce a single vegetable made its appearance.

"When these roosts are first discovered, the inhabitants from considerable distances visit them in the night, with guns, clubs, long poles, pots of sulphur, and various other engines of destruction. In a few hours they fill many sacks, and load their horses with them. By the Indians, a pigeon roost or breeding place is considered an important source of national profit and dependence for that season; and all their active ingenuity is exercised on the occasion. The breeding place differs from the former in its greater extent. In the western countries above-mentioned, these are generally in beech woods, and often extend, in nearly a straight line, across the country for a great way. Not far from Shelbyville, in the State of Kentucky, about five years ago, there was one of these breeding places, which stretched through the woods in nearly a north and south direction; was several miles in breadth, and was said to be upwards of forty miles in extent! In this tract, almost every tree was furnished with nests, wherever the branches could accommodate them. The pigeons made their first appearance there about the 10th of April, and left it altogether, with their young, before the 25th of May.

"As soon as the young were fully grown, and before they left the nests, numerous parties of the inhabitants, from all parts of the adjacent country, came with waggons, axes, beds, cooking utensils, many of them accompanied by the greater part of their families, and encamped for several days at this immense nursery. Several of them informed me, that the noise in the woods was so great as to terrify their horses, and that it was difficult for one person to hear another speak, without bawling in his ear. The ground was strewn with broken limbs of trees, eggs, and young squab pigeons, which had been precipitated from above, and on which herds of hogs were fattening. Hawks, buzzards, and eagles, were sailing about in great numbers, and seizing the squabs from their nests at pleasure; while, from twenty feet upwards to the tops of the trees, the view through the woods presents a perpetual tumult of crowding and fluttering multitudes of pigeons, their wings roaring like thunder, mingled with the frequent crash of falling timber; for now the axe-men were at work, cutting down those trees that seemed to be most crowded with nests, and contrived to fell them in such a manner, that, in their descent, they might bring down several others; by which means the falling of one large tree sometimes produced two hundred squabs, little inferior in size to the old ones, and almost one mass of fat. On some single trees, upwards of one hundred nests were found, each containing one young only; a circumstance in the history

of this bird, not generally known to naturalists. It was dangerous to walk under these flying and fluttering millions, from the frequent fall of large branches, broken down by the weight of the multitudes above, and which, in their descent, often destroyed numbers of the birds themselves; while the clothes of those engaged in traversing the woods were completely covered with the excrements of the pigeons.

"These circumstances were related to me by many of the most respectable part of the community in that quarter; and were confirmed in part, by what I myself witnessed. I passed for several miles through this same breeding place, where every tree was spotted with nests, the remains of those above described. In many instances, I counted upwards of ninety nests on a single tree; but the pigeons had abandoned this place for another, sixty or eighty miles off towards Green river, where they were said at that time to be equally numerous. From the great numbers that were constantly passing over head to or from that quarter, I had no doubt of the truth of this statement. The mast had been chiefly consumed in Kentucky, and the pigeons, every morning a little before sunrise, set out for the Indiana territory, the nearest part of which was about sixty miles distant. Many of these returned before ten o'clock, and the great body generally appeared, on their return, a little after noon.

"I had left the public road to visit the remains of the breeding place near Shelbyville, and was traversing the woods with my gun, on my way to Frankfort, when, about one o'clock, the pigeons, which I had observed flying the greater part of the morning northerly, began to return, in such immense numbers as I never before had witnessed. Coming to an opening, by the side of a creek called the Benson, where I had a more uninterrupted view, I was astonished at their appearance. They were flying, with great steadiness and rapidity, at a height beyond gunshot, in several strata deep, and so close together, that, could shot have reached them, one discharge could not have failed of bringing down several individuals. From right to left, as far as the eye could reach, the breadth of this vast procession extended, seemingly everywhere equally crowded. Curious to determine how long this appearance would continue, I took out my watch to note the time, and sat down to observe them. It was then half-past one. I sat for more than an hour, but, instead of a diminution of this prodigious procession, it seemed rather to increase both in numbers and rapidity; and, anxious to reach Frankfort before night, I rose and went on. About four o'clock in the afternoon I crossed the Kentucky river, at the town of Frankfort, at which time the living torrent above my head seemed as numerous and as extensive as ever. Long after this I observed them, in large bodies, that continued to pass for six or eight minutes, and these again were followed by other detached bodies, all moving in the same south-east direction, till after six in the evening. The great breadth of front which this mighty multitude preserved would seem to intimate a corresponding breadth of their breeding place, which, by several gentlemen, who had lately passed through part of it, was stated to me at several miles. It was said to be in Green county, and that the young began to fly about the middle of March. On the 17th of April, forty-nine miles beyond Danville, and not far from Green river, I crossed this same breeding place, where the nests, for more than three miles, spotted every tree; the leaves not being yet out, I had a fair prospect of them, and was really astonished at their numbers. A few bodies of pigeons lingered yet in different parts of the woods, the roaring of whose wings was heard in various quarters around me.

"All accounts agree in stating, that each nest

contains only one young squab. These are so extremely fat, that the Indians, and many of the whites, are accustomed to melt down the fat, for domestic purposes, as a substitute for butter and lard. At the time they leave the nest, they are nearly as heavy as the old ones; but become much leaner, after they are turned out to shift for themselves.

"It is universally asserted in the western countries, that the pigeons, though they have only one young at a time, breed thrice, and sometimes four times, in the same season; the circumstances already mentioned render this highly probable. It is also worthy of observation, that this takes place during that period when acorns, beech nuts, &c., are scattered about in the greatest abundance, and mellowed by the frost. But they are not confined to these alone,—buckwheat, hempseed, Indian corn, hollyberries, hackberries, huckleberries, and many others, furnish them with abundance at almost all seasons. The acorns of the live oak are also eagerly sought after by these birds, and rice has been frequently found in individuals killed many hundred miles to the northward of the nearest rice plantation. The vast quantity of mast which these multitudes consume is a serious loss to the bears, pigs, squirrels, and other dependants on the fruits of the forest. I have taken, from the crop of a single wild pigeon, a good handful of the kernels of beech nuts, intermixed with acorns and chestnuts. To form a rough estimate of the daily consumption of one of these immense flocks, let us first attempt to calculate the numbers of that above mentioned, as seen in passing between Frankfort and the Indiana territory: If we suppose this column to have been one mile in breadth (and I believe it to have been much more), and that it moved at the rate of one mile in a minute, four hours, the time it continued passing, would make its whole length two hundred and forty miles. Again, supposing that each square yard of this moving body comprehended three pigeons, the square yards in the whole space, multiplied by three, would give two thousand two hundred and thirty millions, two hundred and seventy-two thousand pigeons!—an almost inconceivable multitude, and yet probably far below the actual amount. Computing each of these to consume half a pint of mast daily, the whole quantity at this rate would equal seventeen millions, four hundred and twenty-four thousand bushels per day! Heaven has wisely and graciously given to these birds rapidity of flight and a disposition to range over vast uncultivated tracts of the earth, otherwise they must have perished in the districts where they resided, or devoured up the whole productions of agriculture, as well as those of the forests.

"A few observations on the mode of flight of these birds must not be omitted. The appearance of large detached bodies of them in the air, and the various evolutions they display, are strikingly picturesque and interesting. In descending the Ohio by myself, in the month of February, I often rested on my oars to contemplate their aerial manœuvres. A column, eight or ten miles in length, would appear from Kentucky, high in air, steering across to Indiana. The leaders of this great body would sometimes gradually vary their course, until it formed a large bend, of more than a mile in diameter, those behind tracing the exact route of their predecessors. This would continue sometimes long after both extremities were beyond the reach of sight; so that the whole, with its glittery undulations, marked a space on the face of the heavens resembling the windings of a vast and majestic river. When this bend became very great, the birds, as if sensible of the unnecessary circuitous course they were taking, suddenly changed their direction, so that what was in column before became an immense front, straightening all its inden-

tures, until it swept the heavens in one vast and infinitely extended line. Other lesser bodies also united with each other as they happened to approach, with such ease and elegance of evolution, forming new figures, and varying these as they united or separated, that I was never tired of contemplating them. Sometimes a hawk would make a sweep on a particular part of the column, from a great height, when, almost as quick as lightning, that part shot downwards out of the common track; but, soon rising again, continued advancing at the same height as before. This inflection was continued by those behind, who, on arriving at this point dived down, almost perpendicularly, to a great depth, and rising, followed the exact path of those that went before. As these vast bodies passed over the river near me, the surface of the water, which was before smooth as glass, appeared marked with innumerable dimples, occasioned by the dropping of their dung, resembling the commencement of a shower of large drops of rain or hail.

"The nest of the wild pigeon is formed of a few dry slender twigs, carelessly put together, and with so little concavity, that the young one, when half grown, can easily be seen from below. The eggs are pure white. Great numbers of hawks, and sometimes the bald eagle himself, hover about those breeding places, and seize the old or the young from the nest amidst the rising multitudes, and with the most daring effrontery. The young, when beginning to fly, confine themselves to the under part of the tall woods where there is no brush, and where nuts and acorns are abundant, searching among the leaves for mast, and appear like a prodigious torrent rolling along through the woods, every one striving to be in the front. Vast numbers of them are shot while in this situation. A person told me, that he once rode furiously into one of these rolling multitudes, and picked up thirteen pigeons, which had been trampled to death by his horse's feet. In a few minutes, they will beat the whole nuts from a tree with their wings, while all is a scramble, both above and below, for the same. They have the same cooing notes common to domestic pigeons, but much less of their gesticulations. In some flocks you will find nothing but young ones, which are easily distinguishable by their motley dress. In others, they will be mostly females; and again, great multitudes of males, with few or no females. I cannot account for this in any other way than that, during the time of incubation, the males are exclusively engaged in procuring food, both for themselves and their mates; and the young, being unable yet to undertake these extensive excursions, associate together accordingly. But, even in winter, I know of several species of birds who separate in this manner, particularly the red-winged starling, among which thousands of old males may be found, with few or no young or females along with them."

NOTE D.—Of Dovecots.

That eminent naturalist, Mr. C. Waterton, in an article on the habits of the dovecot pigeon, in the 9th vol. of 'Loudon's Magazine of Natural History,' says: "No farm-yard can be considered complete without a well-stocked dovecot, the contents of which make the owner a most ample return, and repay him abundantly for the depredations which the pigeons are wont to make upon his ripening corn. He commands a supply of delicious young birds for his table; and he has the tillage from the dovecot, which is of vast advantage to his barley land. Moreover, the pigeons render him an essential service, by consuming millions of seeds which fall in the autumn, and which, if allowed to remain on the ground, would rise up the following year, in all the rank exuberance of weed,

and choke the wholesome plant. A dovecot ought to be well lighted; and it should be white-washed once every year. The tillage which it produces may be removed early in November, and again at the end of February. The young of the dovecot pigeon, like all others of the columbine order, are reared in a nest lined by their own dung; which, if left in the hole after the birds are gone, is apt to harbour vermin. Wherefore, cleanliness dictates its early removal. No dovecot can possibly thrive if rats have found an entrance into it. These cruel and audacious plunderers will destroy every young pigeon within their reach. Oust them you must, and preclude their return, be the cost ever so great: otherwise, disappointment will most assuredly be your lot.

"The barn-owl and the starling are harmless unoffending visitors to the dovecot: they repair to it merely for shelter, or for a breeding-place; so that I always like to see them enter mine. It is a lofty and a spacious building; and last season it furnished seventy-three dozens of young pigeons. The walls were made with flues, by the judicious use of which we had a very early supply for the table; but, through some neglect on the part of the attendant, a fire took place, which threatened destruction to the surrounding buildings. In consequence of this, the flues were no longer heated, and they have continued in disuse since that time. Though owls, and hawks, and crows, and magpies, are allowed an unmolested range in the vicinity of this dovecot, still it is acknowledged to be one of the most productive in the county.

"There is a peculiarity in the habits of the dovecot pigeon, which ought not to pass unnoticed. Though this bird will often perch on trees in the daytime, it has never been known to roost on them during the night. Neither will it pass the night in

the open air, except in cases of the greatest emergency. I have an aged elm here, of gigantic size, to which both the dovecot pigeon and the wild ring-pigeon will frequently resort. It is amusing to watch the peculiar habits of these two different species of birds. They seem to come to the tree solely for their own convenience, and not with any intention to enjoy each other's company; and they appear to be as devoid of mutual signs of courtesy, as are our own countrymen when seated in a foreign diligence. I am positive that there will never be a union betwixt the dovecot pigeon and the ring-dove. A long series of observations, which I have been enabled to make, tends to convince me more and more of the impossibility.

"The dovecot pigeons, like the rest of the genus, are remarkable for retiring to their roost at an early hour, and for leaving it late in the morning: thus fulfilling only half of Poor Richard's maxim of,

'Early to bed, and early to rise,
Makes a man healthy, wealthy, and wise.'

"These pigeons never lay more than two eggs at one sitting. Indeed, I should be most surprised were it satisfactorily proved that any pigeon ever sits on three eggs.

"Nothing can surpass the attachment of these birds to the cot of their choice. Provided you do not absolutely molest them by the repeated discharge of fire-arms, they can scarcely be driven from it. You may unroof their habitation; and, though you leave it in that dismantled state for weeks together, still the pigeons will not forsake it. At their early hour of roosting, they will approach within three or four yards of the workmen, and then take shelter in the holes of the roofless walls, where they remain for the night."

BOOK VI.

OF BIRDS OF THE SPARROW KIND.

CHAP. I.

GENERAL OBSERVATIONS.

STILL descending from the larger to the smaller, we come to birds of the sparrow kind; or that class of beautiful little animals that, being less than the pigeon, go on diminishing till we arrive at the humming-bird, the smallest of the feathered creation.

The birds which compose this class chiefly live in the neighbourhood of man, and are his greatest favourites. The falcon may be more esteemed, and the turkey more useful; but these he considers as servants, not as friends; as animals reclaimed merely to supply him with some of the conveniences of life: but these little painted songsters have his affections, as well from their beauty as their melody; it is this delightful class that fill his groves with harmony, and lift his heart to sympathize with their raptures. All

the other classes are either mute or screaming; it is this diminutive tribe only that have voices equal to the beauty of their figures; equally adapted to rejoice man, and delight each other.

As they are the favourites of man, so they are chiefly seen near him. All the great birds dread its vicinity, and keep to the thickest darkness of the forest, or the brow of the most craggy precipice: but these seldom resort to the thicker parts of the wood; they keep near its edges, in the neighbourhood of cultivated fields, in the hedge-rows of farm-grounds, and even in the yard, mixing with the poultry.

It must be owned, indeed, that their living near man is not a society of affection on their part, as they approach inhabited grounds merely because their chief provision is to be found there. In the depth of the desert, or the gloom of the forest, there is no grain to be picked up; none of those tender buds that are so grateful to their appetites; insects themselves, that make so great

a part of their food, are not found there in abundance, their natures being unsuited to the moisture of the place. As we enter, therefore, deeper into uncultivated woods, the silence becomes more profound; everything carries the look of awful stillness; there are none of those warblings, none of those murmurs, that awaken attention, as near the habitations of men; there is nothing of that confused buzz, formed by the united though distant voices of quadrupeds and birds; but all is profoundly dead and solemn. Now and then, indeed, the traveller may be roused from this lethargy of life, by the voice of a heron, or the scream of an eagle; but his sweet little friends and warblers have totally forsaken him.

There is still another reason for these little birds avoiding the depths of the forests; which is, that their most formidable enemies usually reside there. The greater birds, like robbers, choose the most dreary solitudes for their retreats; and if they do not find, they make a desert all around them. The small birds fly from their tyranny, and take protection in the vicinity of man, where they know their more unmerciful foes will not venture to pursue them.

All birds, even those of passage, seem content with a certain district to provide food and centre in. The redbreast or the wren seldom leaves the field where it has been brought up, or where its young have been excluded; even though hunted it flies along the hedge, and seems fond of the place with an imprudent perseverance. The fact is, all these small birds mark out a territory to themselves, which they will permit none of their own species to remain in; they guard their dominions with the most watchful resentment; and we seldom find two male tenants in the same hedge together.

Thus, though fitted by Nature for the most wandering life, these little animals do not make such distant excursions, during the season of their stay, as the stag or the leveret. Food seems to be the only object that puts them in motion, and when that is provided for them in sufficient plenty, they never wander. But as that is seldom permanent through the year, almost every bird is then obliged to change its abode. Some are called *birds of passage*, because they are obliged to take long journeys for this purpose; but, strictly speaking, almost every other kind are birds of passage, though their migration may not be to places so remote. At some particular season of the year all small birds migrate either from one country to another, or from the more inland provinces to the shore.

There are several persons who get a livelihood by watching the seasons when our small birds begin to migrate from one country to another, and by taking them with nets in their passage. The birds are found to fly, as the bird-catchers term it, chiefly during the month of October, and part of September and November. There is also another flight in March, which is much less

considerable than that in autumn. Nor is it less remarkable, that several of these species of flight-birds make their appearance in regular succession. The pipit, for instance, begins his flight every year about Michaelmas, when they are caught in greatest number. To this the wood-lark succeeds, and continues its flight till towards the middle of October; other birds follow, but are not so punctually periodical; the greenfinch does not begin till the frost obliges it to seek for a change. These birds, during those months, fly from daybreak till twelve noon; and there is afterwards a small flight from two till night. Such are the seasons of the migration of the birds, which have been usually considered as stationary, and on these occasions they are caught in great abundance, as they are on their journey. But the same arts used to allure them upon other occasions would be utterly fruitless, as they avoid the nets with the most prudent circumspection. The autumnal flight probably consists of the parents conducting their new-fledged young to those places where there is sufficient provision, and a proper temperament of the air during the winter season; and their return in spring is obviously from an attachment to the place which was found so convenient before for the purposes of nestling and incubation.

Autumn is the principal season when the bird-catcher employs his art to catch these wanderers. His nets are a most ingenious piece of mechanism, being generally twelve yards and a half long, and two yards and a half wide, and so contrived as from a flat position to rise on each side, and clap over the birds that are decoyed to come between them. The birds in their passage are always observed to fly against the wind; hence there is a great contention among the bird-catchers which shall gain the wind; for example, if it is westerly, the bird-catcher who lays his net most to the east is sure of the most plentiful sport, if his call-birds are good. For this purpose he generally carries five or six linnets, two goldfinches, two greenfinches, one wood-lark, one red-poll, and perhaps a bullfinch, a yellow-hammer, a tit-lark, and an aberdavine: these are placed at small distances from the nets in little cages. He has besides what he calls his *flur-birds*, which are placed upon a moveable perch, which the bird-catcher can raise at pleasure by means of a string; and these he always lifts gently up and down as the wild bird approaches. But this is not enough to allure the wild bird down; it must be called by one of the call-birds in the cages; and these, by being made to moult prematurely in a warm cage, call louder and better than those that are wild and at freedom. There even appears a malicious joy in these call-birds to bring the wild ones into the same state of captivity, while at the same time their call is louder, and their plumage brighter, than in a state of nature. Nor is their sight or hearing less exquisite, far exceeding that of the

bird-catcher; for the instant the wild birds are perceived, notice is given by one to the rest of the call-birds, who all unite in the same tumultuous ecstasy of pleasure. The call-birds do not sing upon these occasions as a bird does in a chamber, but incite the wild ones by short jerks, which, when the birds are good, may be heard at a great distance. The allurements of this call is so great that the wild bird hearing it is stopped in its most rapid flight; and, if not already acquainted with the nets, lights boldly within twenty yards perhaps of the bird-catcher, and on a spot which it would otherwise have quite disregarded. This is the opportunity wished for, and the bird-catcher pulling a string, the nets on each side rise in an instant, and clap directly down on the poor little unsuspecting visitant. Nay, it frequently happens, that if half a flock only are caught, the remaining half will immediately afterwards light between the nets, and share the fate of their companions. Should only one bird escape, this unhappy survivor will also venture into danger till it is caught; such a fascinating power have the call-birds.

Indeed, it is not easy to account for the nature of this call, whether it be a challenge to combat, an invitation to food, or a prelude to courtship. As the call-birds are all males, and as the wild birds that attend to their voice are most frequently males also, it does not seem that love can have any influence in their assiduity. Perhaps the wild females, in these flights, attend to and obey the call below, and their male companions of the flight come down to hear them company. If this be the case, and that the females have unfaithfully led their mates into the nets, they are the first that are punished for their infidelity: the males are only made captives for singing; while the females are indiscriminately killed, and sold to be served up to the tables of the delicate.

Whatever be the motives that thus arrest a flock of birds in their flight, whether they be of gallantry or of war, it is certain that the small birds are equally remarkable for both. It is, perhaps, the genial desire that inspires the courage of most animals; and that being greatest in the males, gives them a greater degree of valour than the females. Small birds being extremely amorous, are remarkably brave. However contemptible these little warriors are to large creatures, they are often but too formidable to each other; and sometimes fight till one of them yields up his life with the victory. But their contentions are sometimes of a gentler nature. Two male birds shall strive in song till, after a long struggle, the loudest shall entirely silence the other. During these contentions, the female sits an attentive silent auditor, and often rewards the loudest songster with her company during the season.

Singing among birds is almost universally the prerogative of the male. With them it is the

reverse of what occurs in the human kind. Among the feathered tribe, the heaviest cares of life fall to the lot of the female. Hers is the fatigue of incubation, and to her devolves the principal fatigue of nursing the helpless brood. To alleviate these fatigues, and to support her under them, Nature has given the song to the male.¹ This serves, as a note of blandishment, at

¹ "The question, why do birds sing? has never yet been, I think, satisfactorily answered. It was supposed that the male sang to soothe the female during incubation. There was plausibility in this; but then the question would immediately arise, why are some birds denied song? Do the females of some birds require soothing more than others? Besides, birds sit during the night as well as the day, yet no bird but the nightingale sings during the night. The skylark frequently mounts so high that we not only lose sight of him, but we also lose all trace of his song: can the female then hear him and be soothed by his notes? Barrington supposed the female to be silent, 'lest her song should discover her nest.' A singular conclusion, certainly, at the same time that it was supposed that the male sang to soothe the female during the period of incubation. If the song were poured forth for this soothing purpose, it must of course have been in the near neighbourhood of the nest, and consequently would be as likely to discover the nest as if the female herself sang; besides, do not the females of some birds sing occasionally, as well as the males? Now comes another theory. 'The males of song birds do not, in general, search for the females, but, on the contrary, their business in the spring is to perch upon some conspicuous spot, breathing out their full and natural notes, which, by instinct, the female knows, and repairs to the spot to choose her mate.' The female amongst birds has evidently the advantage over the human species, for she is the chooser, and not the object of choice. The same author tells us, that 'birds cannot discriminate the colours by which their species is known?' and this is evidently put forth to account for the male 'perching upon some conspicuous spot.' But what say others? The nightingale sings 'concealed in the thickest part of a bush or small tree.' (*Field Nat. Mag.*, i. 201.) Both statements are fact. The nightingale does sing in the concealment of a thick bush, and the song thrush sings, morning and evening, mounted on the highest spray he can find. I cannot suppose that he does this to lure the female to him, for I have never observed it to have that effect; besides, he does it for a very considerable portion of spring and summer; certainly after he is mated. Neither can I suppose that his song is poured forth for the purpose of soothing the female during the period of incubation; for, if that were the case, the soothing would be required as much by night as by day, and as much in the middle of the day as in the morning and the evening: besides this, he frequently sings at Christmas, when he is neither mated nor seeking a mate. Let us come, however, to a still later opinion. 'The songs of birds have given rise to several curious inquiries of no small interest. After investigating the subject with considerable attention for several years, we have come to the conclusion that the notes of birds, which we denominate singing, may all be referred to hilarity and joy, or to rivalry and defiance.' (*Rennie's Habits of Birds*, 260.) In making this theory hold good, I think we shall find as many difficulties as in any other. Why is the nightingale more joyous than other birds during the night? Is the redbreast habitually more joyous than other birds? for he sings nearly the whole year round. If it be joy that stim-

first to attract her affections; it serves as a note to delight her during the time of her incubation; but it serves still farther as a note of security, to assure her that no danger threatens to molest her. The male, while his mate is hatching, sits upon some neighbouring tree, continuing at once to watch and to sing. While his voice is heard, the female rests in confident security; and, as the poet expresses it, appears *most bless'd when most unseen*: but if any appearance of danger offers to intrude, the male, that a moment before was so loud and sportive, stops all of a sudden; and this is a most certain signal to his mate to provide for her own security.²

The nest of little birds seems to be of a more delicate contrivance than that of the larger

ulates to song, why do not the females sing as well as the males: have they no joy? And why are some birds altogether denied song: are they joyless? The thrush breaks forth into song frequently in the winter, and the woodlark makes the December mornings resound with his song. How is it that these birds are so joyous when all others are gloomy? The meadow pipit, again, when disturbed from her nest, will mount up into the air to a considerable height, and then descend slowly, warbling with all her powers, until she reaches the ground. Is it any source of joy to the bird to be thus disturbed from her nest? This may be said to be 'defiance.' To this I have only to reply, it is the usual and general note, and certainly a source of considerable pleasure to the rambler over our mountains, where they abound. But we must, I am fearful, conclude where we began: Why do birds sing?—*Loudon's Magazine of Natural History*, vol. vii. pp. 484—486.

² In Montagu's 'Ornithological Dictionary,' under the article 'Song of Birds,' there is the following remark:—Regarding the note of alarm which birds utter on the approach of their natural enemies, whether a hawk, an owl, or a cat, we consider it to be a general language, perfectly understood by all small birds, though each species has a note peculiar to itself. A correspondent in 'Loudon's Magazine of Natural History,' says: "I was, last April, very much pleased at witnessing an illustration of the truth of this opinion. I found a nest of young throats at the root of a hazel; and although they could scarcely fly, yet, as they were near a footpath, and the next day was Sunday, when many idle and mischievous lads would be rambling about, I thought they would be safer out of their nest than in it; and as I knew that, when so far fledged, if they were once disturbed they would not continue in the nest, I took one out, and made it cry out, and then put it back again, but in one minute not only it but its three companions had disappeared in the long dry grass which was round about. On hearing the cry of their young one, the parent bird set up such a shriek of alarm as brought all the birds in the wood to see what was the matter. I noticed the blackbird, the chaffinch, the titlark, the redbreast, the oxeye [greater titmouse], the blue and marsh titmouse, and the wren, all uttering their cries of alarm and apprehension: even the golden-crested wren, which usually seems to care for nothing, was as forward and as persevering as any of them in expressing its fear on this occasion; indeed, the only bird which seemed indifferent to all these manifestations of alarm was the creeper, which continued its anxious and incessant search for food as it flitted from one tree to another, examining them from root to branch, without ever seeming to understand or care for what seemed to have so much frightened all the others."—Ed.

kinds. As the volume of their bodies is smaller, the materials of which their nests are composed are generally warmer. It is easy to conceive that small things keep heat a shorter time than those that are large. The eggs, therefore, of small birds require a place of more constant warmth than those of great ones, as being liable to cool more quickly; and accordingly their nests are built warmer and deeper, lined on the inside with softer substances, and guarded above with a better covering. But it sometimes happens that the little architects are disturbed in their operations, and then they are obliged to make a nest, not such as they wish, but such as they can. The bird whose nest has been robbed several times, builds up her last in a very slovenly manner, conscious that, from the near approach of winter, she must not take time to give her habitation every possible advantage it is capable of receiving. When the nest is finished, nothing can exceed the cunning which the male and female employ to conceal it. If it is built in bushes, the pliant branches are so disposed as to hide it entirely from the view; if it be built among moss, nothing outwardly appears to show that there is a habitation within. It is always built near those places where food is found in greatest abundance; and they take care never to go in or out while there is any one in sight. The greater birds continue from their nest for some time, as their eggs take no damage in their absence; but the little birds are assiduous while they sit, and the nest is always occupied by the male when the female is obliged to seek for sustenance.

The first food of all birds of the sparrow kind is worms and insects. Even the sparrow and the goldfinch, that when adult feed only upon grain, have both been fed upon insects while in the nest. The young ones, for some time after their exclusion from the shell, require no food; but the parent soon finds, by their chirping and gaping, that they begin to feel the approaches of hunger, and flies to provide them a plentiful supply. In her absence they continue to lie close together, and cherish each other by their mutual warmth. During this interval also they preserve a perfect silence, uttering not the slightest note, till the parent returns. Her arrival is always announced by a chirrup, which they perfectly understand, and which they answer all together, each petitioning for its portion. The parent distributes a supply to each by turns, cautiously avoiding to gorge them, but to give them often, though little at a time. The wren will in this manner feed seventeen or eighteen young ones without passing over one of them.

Such is the manner in which these birds bring forth and hatch their young; but it remains to usher them from the nest into life, and this they very assiduously perform. When they are fully fledged, and fitted for short flights, the old ones, if the weather be fair, lead them a few yards

from the nest, and then compel them to return. For two or three succeeding days they are led out in the same manner, but each day to seek more distant adventures. When it is perceived that they can fly, and shift for themselves, then the parents forsake them for ever, and pay them no more attention than they do to other birds in the same flock. Indeed, it would seem among these little animals that, from the moment their young are set out, all future connexion ceases between the male and the female; they go separate ways, each to provide for itself during the rigours of winter; and at the approach of spring each seeks for a new associate.

In general, birds, when they come to pair in the spring, associate with those of their own age and place of abode. Their strength or courage is generally in proportion to their age: the oldest females first feel the accessions of desire, and the oldest males are the boldest to drive off all younger pretenders. Those next in courage and desire become pretenders, till they are almost all provided in turn. The youngest come last; as, in fact, they are the latest in their inclinations. But still there are several, both males and females, that remain unprovided for; either not happening to meet with each other, or at least not during the genial interval. Whether these mix with small birds of a different species, is a doubt which naturalists have not been able thoroughly to resolve. Addison, in some beautiful Latin lines, inserted in the *Spectator*, is entirely of opinion that birds observe a strict chastity of manners, and never admit the caresses of a different tribe.

Chaste are their instincts, faithful is their fire,
No foreign beauty tempts to false desire:
The snow-white vesture, and the glittering crown,
The simple plumage, or the glossy down,
Prompt not their love. The patriot bird pursues
His well acquainted tints, and kindred hues:
Hence thro' their tribes no mix'd polluted flame,
No monster-breed to mark the groves with shame:
But the chaste blackbird, to its partner true,
Thinks black alone is Beauty's fav'rite hue:
The nightingale, with mutual passion bless'd,
Sings to its mate, and nightly charms the nest:
While the dark owl, to court his partner flies,
And owns his offspring in their yellow eyes.

But whatever may be the poet's opinion, the probability is against this fidelity among the smaller tenants of the grove. The great birds are much more true to their species than these; and, of consequence, the varieties among them are more few. Of the ostrich, the cassowary, and the eagle, there are but few species; and no arts that man can use could probably induce them to mix with each other.

But it is otherwise with the small birds we are describing; it requires very little trouble to make a species between a goldfinch and a canary-bird, between a linnet and a lark. They breed frequently together; and produce a race, not like the mules among quadrupeds, incapable of breeding again; for this motley mixture are

as fruitful as their parents. What is so easily done by art, very probably happens in a state of nature; and when the male cannot find a mate of his own species he flies to one of another, that, like him, has been left out in pairing. This, some historians think, may have given rise to the great variety of small birds that are seen among us; some uncommon mixture might first have formed a new species, and this might have been continued down, by birds of this species choosing to breed together.

Whether the great variety of our small birds may have arisen from this source cannot now be ascertained; but certain it is that they resemble each other very strongly, not only in their form and plumage, but also in their appetites and manner of living. The goldfinch, the linnet, and the yellow-hammer, though obviously of different species, yet lead a very similar life; being equally an active, lively, salacious tribe, that subsist by petty thefts upon the labours of mankind, and repay them with a song. Their nests bear a similitude; and they are all about the same time in hatching their young, which is usually fifteen days. Were I, therefore, to describe the manners of these with the same minuteness that I have done the greater birds, I should only present the reader with a repetition of the same accounts; animated neither by novelty nor information. Instead, therefore, of specifying each sort, I will throw them into groups; uniting those together that practise the same manners, or that are remarkable for similar qualifications.

Willoughby has divided all the smaller birds into those that have slender bills, and those that have short and thick bills. Those with slender bills, chiefly live upon insects; those with short strong bills, live mostly upon fruits and grain. Among slender-billed birds he enumerates the thrush, the blackbird, the fieldfare, the starling, the lark, the titmouse, the water-wagtail, the nightingale, the red start, the robin-redbreast, the beccafigo, the stone-chatter, the whin-chat, the goldfinch, the white-throat, the hedge-sparrow, the pettichaps, the golden-crowned wren, the wren, the humming-bird, and several other small birds of the sparrow-kind, unknown in this part of the world.

All these, as was said, live for the most part upon insects; and are consequently of particular benefit to man. By these are his grounds cleared of the pernicious swarms of vermin that devour the budding leaves and flowers; and that even attack the root itself, before ever the vegetable can come to maturity. These seek for and destroy the eggs of insects that would otherwise propagate in numbers beyond the arts of man to extirpate; they know better than man where to seek for them; and thus at once satisfy their own appetites, and render him the most essential services.

But this is not the only merit of this tribe: in it we have the sweetest songsters of the grove;

their notes are softer, and their manner more musically soothing, than those of hard-billed birds. The foremost in musical fame are the nightingale, the thrush, the blackbird, the lark, the redbreast, the black-cap, and the wren.

Birds of the sparrow-kind, with thick and short bills, are the cross-beak, the green-finch, the bull-finch, the crossbill, the house-sparrow, the chaffinch, the brambling, the gold-finch, the linnet, the siskin, the bunting, the yellow-hammer, the ortlan, the wheat-ear, and several other foreign birds, of which we know rather the names than the history. These chiefly feed upon fruits, grain, and corn. They are often troublesome to man, as they are a numerous tribe; the harvest often suffers from their depredations; and while they are driven off from one end of the field, they fly round, and come in at the other. But these also have their uses: they are frequently the distributors of seeds into different districts; those grains which they swallow are sometimes not wholly digested; and these, laid upon a soil congenial to them, embellish the face of nature with that agreeable variety which art but vainly attempts to imitate. The mistletoe plant, which we often see growing on the tops of elm and other trees, has been thought to be propagated in this manner; yet, as it is often seen growing on the under side of the branch, and sometimes on a perpendicular shoot, it seems extraordinary how a seed could be deposited in that situation. However this be, there are many plants propagated from the depositions of birds; and some seeds are thought to thrive the better for first having undergone a kind of maceration in the stomach of the little animal, before it is voided on the ground.

There are some agreeable songsters in this tribe also; and those who like a loud piercing pipe, endued with great variety and perseverance, will be pleased most with their singing. The songsters of this class are the canary-bird, the linnet, the chaffinch, the gold-finch, the green-finch, the bull-finch, the brambling, the siskin, and the yellow-hammer. The note of these is not so generally pleasing as that of the soft-billed birds, but it usually holds longer; and, in a cage, these birds are more easily fed, and more hardy.³

³ *Voices of Birds.*—"We note birds in general more from their voices than their plumage; for the carols of spring may be heard involuntarily, but to observe the form and decoration of these creatures requires an attention not always given. Yet we have some native birds beautifully and conspicuously feathered; the gold-finch, the chaffinch, the wagtails, are all eminently adorned, and the fine gradations of sober browns in several others are very pleasing. Those sweet sounds, called the song of birds, proceed only from the male; and, with a few exceptions, only during the season of incubation. Hence the comparative quietness of our summer months, when this care is over, except from accidental causes, where a second nest is formed; few of our birds bringing up more than one brood in the season. The redbreast,

This class of small birds, like all the greater, has its wanderers, that leave us for a season, and then return, to propagate, to sing, or to embellish the landscape here. Some of this smaller kind, indeed, are called *birds of passage*, that do not properly come under that denomination; for though they disappear in one place they never leave the kingdom, but are seen somewhere else. But there are many among them that take longer flights, and go to a region colder or warmer, as it suits their constitutions. The fieldfare and the red-wing breed pass their summers in Norway, and other cold countries, and are tempted hither to our mild winters, and to those various berries which then abound with us, and make their principal food. The hawfinch and the crossbill are uncertain visitants, and have no stated times of migration. Swallows of

blackbird, and thrush, in mild winters, may continually be heard, and form exceptions to the general procedure of our British birds; and we have one little bird, the woodlark (*Alauda arborea*), that, in the early parts of the autumnal months, delights us with its harmony, and its carols may be heard in the air commonly during the calm sunny mornings of this season. They have a softness and quietness, perfectly in unison with the sober, almost melancholy, stillness of the hour. The skylark also sings now, and its song is very sweet, full of harmony, cheerful as the blue sky and gladdening beam in which it circles and sports, and known and admired by all; but the voice of the woodlark is local—not so generally heard—from its softness, must almost be listened for, to be distinguished, and has not any pretensions to the hilarity of the former. This little bird sings likewise in the spring; but at that season, the contending songsters of the grove, and the variety of sound proceeding from everything that has utterance, confuse and almost render inaudible the placid voice of the woodlark. It delights to fix its residence near little groves and copses, or quiet pastures, and is a very unobtrusive bird, not uniting in companies, but associating in its own little family-parties only, feeding in the woodlands on seeds and insects. Upon the approach of man, it crouches close to the ground, then suddenly darts away, as if for a distant flight, but settles again almost immediately. This lark will often continue its song, circle in the air, a scarcely visible speck, by the hour together; and the vast distance from which its voice reaches us in a calm day is almost incredible. In the scale of comparison, it stands immediately below the nightingale in melody and plaintiveness; but compass of voice is given to the linnet, a bird of very inferior powers. The strength of the larynx and of the muscles of the throat in birds is infinitely greater than in the human race. The loudest shout of the peasant is but a feeble cry, compared with that of the golden-eyed duck, the wild goose, or even this lark. The sweet song of this poor little bird, with a fate like that of the nightingale, renders it an object of capture and confinement, which few of them comparatively survive. I have known our country bird-catchers take them by a very simple but effectual method. Watching them to the ground, the wings of a hawk, or of the brown owl stretched out, are drawn against the current of air by a string, as a paper kite, and made to flutter and vibrate like a kestrel over the place where the woodlark has lodged; which so intimidates the bird, that it remains crouching and motionless as a stone on the ground; a hand net is brought over it, and it is caught."—*Journal of a Naturalist.*

every species disappear at the approach of winter. The nightingale, the black-cap, the fly-catcher, the willow-wren, the wheat-ear, the whin-chat, and the stone-chatter leave us long before the approach of winter; while the siskin and the linnet only forsake us when our winters are more than usually severe. All the rest of the smaller tribe never quit this country: but support the severest rigours of the climate.

Yet it must not be supposed that the manners of our little birds prevail in all other countries; and that such kinds as are stationary with us never wander in other parts of Europe; on the contrary, it happens that many of those kinds which are birds of passage in England are seen, in other places, never to depart, but to make one country their fixed residence the whole year round. It is also frequent, that some birds, which with us are faithful residents, in other kingdoms put on the nature of birds of passage, and disappear for a season.

The swallow, that with us is particularly remarked for being a bird of passage, in Upper Egypt and in the island of Java breeds and continues the whole year, without ever disappearing. Larks, that remain with us the year throughout, are birds of passage in Sweden; and forsake that climate in winter to return again with the returning spring. The chaffinch, that with us is stationary, appears during the winter in Carolina and Virginia; but disappears totally in summer to breed in the more northern regions. In Sweden, also, these little birds are seen returning, at the approach of spring, from the warmer climates, to propagate; which being accomplished by the latter end of autumn, the males and females separate; the males to continue among their native snows, the females to seek a warmer and gentler winter. On this occasion, they are seen in flocks, that darken all the air, without a single male among them, making their way into the more southern regions of Denmark, Germany, and Holland. In this Amazon-like retreat thousands fall by the way; some by fatigue, some by want; but the greatest number by the nets of the fowler; the taking them being one of the chief amusements among the gentry where they pass. In short, the change of country with all this little tribe, is rather a pilgrimage than a journey; a migration rather of necessity than of choice.

Having thus given a general idea of the birds of this class, it will be proper to give some account of the most remarkable among them.

CHAP. II.

OF THE THRUSH, AND ITS AFFINITIES.

WITH the thrush we may rank the red-wing, the field-fare, the blackbird, the ring-ouzel, and the water-ouzel. These are the largest of the

sparrow-kind, and may be distinguished from all others of this class, as well by their size, which is well known, as by their bills, which are a little bending at the point; a small notch near the end of the upper chap; and the outmost toe adhering as far as the first joint of the middle toe. To this tribe may be also added the stare or starling, which, though with a flat bill, too much resembles these birds to be placed any where else.

The missel-thrush is distinguished from all of the kind by its superior size, being much larger than any of them. It differs scarcely in any other respect from the throistle, except that the spots on the breast are larger. It builds its nest in bushes, or on the side of some tree, as all of this kind are found to do, and lays four or five eggs in a season. Its song is very fine, which it begins in spring, sitting on the summit of a high tree. It is the largest bird of all the feathered tribe that has music in its voice; the note of all greater birds being either screaming, chattering, or croaking. It feeds on insects, holly, and misletoe-berries; and sometimes sends forth a very disagreeable scream when frightened or disturbed.¹

The blackbird, which in cold countries, and particularly upon the Alps, is sometimes seen all over white, is a beautiful and canorous bird, whistling all the spring and summer time with a note, at a distance, the most pleasing of all the grove. It is the deepest toned warbler of the woods; but it is rather unpleasant in a cage, being loud and deafening. It lays four or five bluish eggs, in a nest usually built at the stump of some old hawthorn, well plastered on the inside with clay, straw, and hair.²

Pleasing, however, as this bird may be, the blue-bird, described by Bellonius, is in every respect far superior. This beautiful animal entirely resembles a blackbird in all but its blue-colour. It lives in the highest parts of the Alps, and even there chooses the most craggy rocks and the most frightful precipices for its residence. As it is rarely caught, it is in high estimation even in the countries where it breeds, but still more valuable when carried from home. It not only whistles in the most delightful manner, but speaks with an articulate distinct voice. It is so docile, and observes all things with such diligence, that though waked at midnight by any of the family, it will speak and whistle at the word of command. Its colour, about the beginning of winter, from blue becomes black, which changes to its original hue on the first approaches of spring. It makes its nest in deep holes, in very high and inaccessible solitudes, and removes it not only from the accesses of man, but also hides it with surprising cunning from the sham-moy and other wild beasts that might annoy its young.

¹ See Supplementary Note A, p. 127. ² Ibid.

The manner of taking this beautiful bird is said to be this. The fowlers, either by chance or by lying in wait, having found out the place where it builds, take with them a strong stilt or stake, such as the climbers of rocks make use of to assist them in their ascent. With the assistance of this, they mount where an indifferent spectator would think it impossible to ascend, covering their heads at the same time to ward off any danger of the falling of pebbles or stones from above. At length, with extreme toil and danger, having arrived at the nest, they draw it up from the hole in which it is usually buried, and cherish the young with an assiduity equal to the pains they took to obtain them. It produces for the most part five young, and never more; it seldom descends into the plain country, flies swifter than a blackbird, and uses the same food.

The fieldfare and the red-wing make but a short stay in this country. With us they are insipid tuneless birds, flying in flocks, and excessively watchful to preserve the general safety. All their season of music and pleasure is employed in the more northern climates, where they sing most delightfully, perched among the forests of maples, with which those countries abound. They build their nest in hedges; and lay six bluish-green eggs spotted with black.³

The starling, distinguishable from the rest of this tribe by the glossy green of its feathers in some lights, and the purple in others, breeds in hollow trees, caves of houses, towers, ruins, cliffs, and often in high rocks over the sea. It lays four or five eggs of a pale greenish ash-colour, and makes its nest of straw, small fibres of roots, and such like. Its voice is rougher than the rest of this kind; but what it wants in the melody of its note, it compensates by the facility with which it is taught to speak. In winter these birds assemble in vast flocks, and feed upon worms and insects. At the approach of spring they assemble in fields as if in consultation together, and for three or four days seem to take no nourishment: the greater part leave the country; the rest breed here, and bring up their young.⁴

To this tribe might be added above a hundred other birds of nearly the thrush size, and living like them upon fruit and berries. Words could not afford variety enough to describe all the beautiful tints that adorn the foreign birds of the thrush kind. The brilliant green of the emerald, the flaming red of the ruby, the purple of the amethyst, or the bright blue of the sapphire, could not, by the most artful combination, show any thing so truly lively or delightful to the sight, as the feathers of the chilcoqui or the tautotal. Passing, therefore, over these beautiful, but little known, birds, I will only mention the American mock-bird, the favourite songster

of a region, where the birds excel rather in the beauty of their plumage than the sweetness of their notes.

This valuable bird does not seem to vie with the feathered inhabitants of that country in the beauty of its plumage, content with qualifications that endear it to mankind much more. It is but a plain bird to the eye, about the size of a thrush, of a white and gray colour, and a reddish bill. It is possessed not only of its own natural notes, which are musical and solemn, but it can assume the tone of every other animal in the wood, from the wolf to the raven. It seems even to sport itself in leading them astray. It will, at one time, allure the lesser birds with the call of their males, and then terrify them, when they have come near, with the screams of the eagle. There is no bird in the forest but it can mimic; and there is none that it has not, at times, deceived by its call. But, not like such as we usually see famed for mimicking with us, and which have no particular merit of their own, the mock-bird is ever surest to please when it is most itself. At those times it usually frequents the houses of the American planters; and, sitting all night on the chimney-top, pours forth the sweetest and the most various notes of any bird whatever. It would seem, if accounts be true, that the deficiency of most other song-birds in that country is made up by this bird alone. They often build their nests in the fruit trees about houses, feed upon berries and other fruits, and are easily rendered domestic.⁵

⁵ See Supplementary Note C, p. 132.

NOTE A.—*The British Thrushes.*

The thrush genus is divided by Temminck into two sections, viz. those that inhabit woods and thickets in the lower grounds; and such as live solitary, in rocky and mountainous countries. The British species all belong to the first section.

The *missel-thrush* is the largest of its tribe, and is indigenous in Great Britain; but its distribution is not so extensive, nor locally so abundant as that of the song-thrush and blackbird. Except during the period of the production of its young, it is a bird of shy and retired habits, frequenting the outskirts of woods, or extensive pastures, where it feeds upon worms and other insects. During the winter, it lives chiefly upon the berries of the misletoe and juniper, with those of the hawthorn, holly, and ivy. It possesses a very powerful note, and, in case of mild weather, its song is often heard as early as the month of January. It usually sings from the highest branch of some tall tree, continuing daily to serenade its mate during the time of incubation, but becomes silent as soon as the young birds are hatched. It is very courageous in the breeding season, attacking indiscriminately all other birds that approach its nest. When disturbed, or engaged in contest, it utters a harsh kind of scream. It seldom mingles with the other species of thrushes, but more frequently associates in small families during the winter, and which resort to extensive pasture and meadow lands. The place chosen for nidification is commonly the cleft of a tree, and the nest is formed externally of white moss and coarse grass, interwoven with wool, the whole being lined with the fine stalks of

³ See Supplementary Note A, *sub.*

⁴ See Supplementary Note B, p. 130.

dead grasses. In this depository it lays four or five eggs, of a greenish-white, spotted, and speckled with chestnut-brown and clove-brown.

The *field-fare*.—The summer retreat, or polar migration of the field-fare being farther towards the north than the utmost latitude of our island, it becomes a periodical visitant with us, as a return to warmer latitudes on the approach of autumn, or after it has performed the duties attendant on the propagation of its species. Of all our winter visitants, it is the latest in its arrival, seldom reaching these shores before the latter part of November. As its first appearance is so much later than that of its fellows in migration, so also is its departure in the spring; flocks of these birds remaining on our coasts as late as the latter part of May, or the first week of June. During its abode with us, it continues in large flocks, and, as long as the weather remains mild, frequents the meadow and pasture grounds, feeding upon slugs, worms, and the larvæ of insects. In severe frosts, and when the ground is covered with snow, it resorts to the hedges, and to small plantations, where it subsists upon the berries of the hawthorn, holly, mountain-ash, and some others. It is a bird of shy disposition, and, unless pressed by hunger, and reduced by want, will not allow of any near approach to it. Highly as the flesh of the field-fare was prized by the Romans, it does not exceed in flavour that of the mistletoe thrush, and the others of its tribe, possessing also a bitterness from which some of them are free. This bird builds in pine or fir trees, in Norway, Sweden, Lapland, and other Northern countries, laying from three to five eggs, of a pale bluish-green colour, spotted with reddish-brown.

The *song-thrush* or *mavis*, whose sweetly variable notes enliven our groves, from the commencement of spring to the close of summer, is indigenous in Britain, as the greater part of those bred in the island remain stationary through the whole year. But these our native birds are augmented by the visits of vast flocks, in the course of their autumnal journey from the more northern countries of Europe. These last generally make their appearance before the red-wing and field-fare, and, after recruiting their strength for a few days, move onward in a southerly direction. Like many of our other autumnal visitants, they arrive with a north, or north-east wind, plainly indicating the countries from whence they hold their progress. The thrushes which remain with us, never associate in flocks during the winter, like the two above-mentioned species, but continue dispersed throughout the country, haunting the thickets and hedges, where they find a supply of such berries as form their principal food, during the inclement season of the year. Upon the approach of very severe frosts, or falls of snow, they move from the interior of the country towards the sea-coast, where the influence of the sea-breeze, soon dissolving the snow, exposes a portion of ground sufficient to furnish them with a scanty subsistence. If the season should prove temperate, the male bird begins to pour forth his love-notes as early as the latter part of January, or the beginning of the month following. In March the pair commence nidification, and the first brood flies about the month of May.

The song-thrush is remarkable for the ingenuity of its nests. The interior of these nests is about the form and size of a large breakfast tea-cup, being as uniformly rounded, and though not polished, almost as smooth. For this little cup the parent birds lay a massive foundation of moss, chiefly the proliferous and the fern-leaved feather moss or any other which is sufficiently tufted. As the structure advances, the tufts of moss are brought into a rounded wall by means of grass stems, wheat-straw, or root, which are twined with it and with one another up

to the brim of the cup, where a thicker band of the same materials is hooped round like the mouth of a basket. The rounded form of this frame-work is produced by the bird measuring it, at every step of the process, with its body, particularly the part extending from the thigh to the chin; and when any of the straws or other materials will not readily conform to this gauge, they are carefully glued into their proper place by means of saliva,—a circumstance which may be seen in many parts of the same nest if carefully examined. When the shell, or frame, as it may be called, is completed in this manner, the bird begins the interior masonry by spreading pellets of horse or cow dung on the basket-work of moss and straw, beginning at the bottom, which is intended to be the thickest, and proceeding gradually from the central point. This material, however, is too dry to adhere of itself with sufficient firmness to the moss, and on this account it is always laid on with the saliva of the bird as a cement; yet it must require no little patience in the little architect to lay it on so very smoothly, with no other implement besides its narrow pointed bill. It would indeed puzzle any of our best workmen to work so uniformly smooth with such a tool; but from the frame being nicely prepared, and by using only small pellets at a time, which are spread out with the upper part of the bill, the work is rendered somewhat easier. This wall being finished, the birds employ for the inner coating little short slips of rotten wood, chiefly that of the willow; and these are firmly glued on with the same salivary cement, while they are bruised flat at the same time, so as to correspond with the smoothness of the surface over which they are laid. This final coating, however, is seldom extended so high as the first, and neither of them are carried quite to the brim of the nest, the birds thinking it enough to bring their masonry near to the twisted band of grass, which forms the mouth. The whole wall, when finished, is not much thicker than paste-board, and though hard, tough, and water-tight, is more warm and comfortable than at first view might appear, and admirably calculated for protecting the eggs or young from the bleak winds which prevail in the early part of the spring, when the song-thrush breeds.

The song-thrush usually builds in a thick bush, hawthorn, holly, silver-fir, furze, ivied tree, or sometimes in a dead fence, where the grass grows high; but it has occasionally been known to nestle within out-buildings. One is mentioned in the 'Magazine of Natural History,' as having been built upon a harrow. A mill-wright "had been making a threshing-machine for a farmer in the neighbourhood of Pitlessie, in Fife, and had three of his men along with him. They wrought in a cart-shed, which they had used for some time as their workshop; and one morning they observed a mavis (thrush) enter the wide door of the shed, over their heads, and fly out again after a short while; and this she did two or three times, until their curiosity was excited to watch the motions of the birds more narrowly; for they began to suspect that the male and female were both implicated in this issue and entry. Upon the joists of the shed were placed along with some timber for agricultural purposes and old implements, two small harrows, used for grass-seeds, laid one above the other; and they were soon aware that their new companions were employed with all the diligence of their kind in making their nest in this singular situation. They had built it, he said, between one of the butts of the harrow and the adjoining tooth; and by that time, about seven o'clock, and an hour after he and his lads had commenced their work, the birds had made such progress, that they must have begun by the break of day. Of course, he did not fail to remark the future proceedings of his new friends

Their activity was incessant; and he noticed that they began to carry mortar (he said), which he and his companions well knew was for plastering the inside. Late in the same afternoon, and at six o'clock next morning, when the lads and he entered the shed, the first thing they did was to look at the mavis's nest, which they were surprised to find occupied by one of the birds, while the other plied its unwearied toil. At last the sitting bird, or hen, as they now called her, left the nest likewise; and he ordered one of the apprentices to climb the baulks, who called out that she had laid an egg; and this she had been compelled to do some time before the nest was finished; only plastering the bottom, which could not have been done so well afterwards. When all was finished, the cock took his share in the hatching; but he did not sit so long as the hen, and he often fed her while she was upon the nest. In thirteen days the young birds were out of the shells, which the old ones always carried off."

"Thrushes," says Jesse, "feed very much on snails, looking for them in mossy banks. Having frequently observed some broken snail-shells near two projecting pebbles on a gravel walk, which had a hollow between them, I endeavoured to discover the occasion of their being brought to that situation. At last I saw a thrush fly to the spot with a snail shell in his mouth, which he placed between the two stones and hammered at it with his beak till he had broken it, and was then able to feed on its contents. The bird must have discovered that he could not apply his beak with sufficient force to break the shell while it was rolling about, and he therefore found out and made use of the spot which would keep the shell in one position."

Grahame, in his 'Birds of Scotland,' gives, as usual, a very exact account of the localities chosen by the song-thrush, though he is wrong in thinking the nest lined with loam.

"In the hazel bush or sloe is formed
The habitation of the wedded pair,
Sometimes below the never-fading leaves
Of ivy-close, that overtwisting binds,
And richly crowns, with clustered fruit of spring,
Some river rock, or nodding castle wall;
Sometimes beneath the jutting root of elm,
Or oak, among the sprigs, that overhang
A pebble chiding stream, the loam-lined house
Is fixed, well hid from ken of hovering hawk,
Or lurking beast, or school-boy's prowling eye."

Syme, on the other hand, says, the thrush "displays little ingenuity in concealing its nest; it is therefore easily found, and hence becomes an easy prey to boys, cats, and weasels. Both male and female are employed in constructing the nest, which is placed in a hedge or bush pretty near the ground. We have found them in hedges, thorn bushes, and amongst the under branches of spruce and silver firs. These last conceal it, for the branches must be lifted up or put aside before the nest can be discovered; but in hedges it is easily seen, as instinct compels the bird to build so early in spring, that the foliage has not time to conceal it."

The red-wing, like the field-fare, is a periodical visitant, and generally makes its appearance a few weeks prior to that bird, arriving upon our north-eastern coasts about the middle or latter part of October. During its residence here, it remains gregarious, and haunts the meadows and pastures, as long as open weather continues; on the approach of frost, repairing to woods and hedges, where the hawthorn, holly, and some other trees afford, by their berries, the necessary means of subsistence. Should the weather prove very severe, or a failure of food occur, they continue their migration southward, an instance of which happened in the winter of 1822. In the first storm of snow, which lasted for nearly three weeks, large flocks of field-fares and red-wings were collected about the hedges, and on

the outskirts of woods, where they lived upon the berries of the hawthorn, and which fortunately for them, were in great abundance. This supply, however, rapidly decreased; but before its total failure, a few days of thaw intervened previous to the commencement of the second severe storm. Taking advantage of this change of weather, they were enabled to pursue a more extended southern migration, and scarcely an individual was afterwards seen in Northumberland. Montague mentions, that, in the hard winter of 1799, vast numbers of these birds resorted to the west of England, where a sudden fall of snow deprived them of all food, and being previously too much reduced for farther travel to a warmer climate, thousands of them, as well as of field-fares, perished from starvation. The same accident occurred in the year 1814, the winter of which proved particularly fatal to the thrush tribe, to larks, and other small birds, as was evinced in the striking diminution of their numbers for some years afterwards. The habits of this bird are very similar to those of the other species.—It has a clear and melodious note, and its song, when in its native or summer residence, is said to be scarcely inferior to that of our common thrush. Upon the approach of spring it returns to the northern provinces of Europe, where it breeds, and passes the summer. It is very abundant in Sweden, Norway, Lapland, and Russia.—In these countries it inhabits the woods and thickets adjoining to low or marshy tracts, and builds in maple, birch, and other trees, laying from four to six eggs, of a bluish-green colour, marked with blackish-brown spots.—In addition to fruits and berries, it feeds upon insects and worms.

The Blackbird is well known as a native of the British Islands. It is of a shy and restless disposition, always anxious to escape from observation, and generally successful in that effort, as it hops with singular celerity through the closest hedges or thickets, and its presence is often only known by the note it utters on alarm. It never associates ostensibly, preferring a solitary life, which it passes in woods or in well enclosed situations, where the hedges afford it an abundant supply of provision for the winter.—It also feeds upon worms and insects, and like the thrush, is particularly fond of the *helix nemoralis*, to obtain the snail of which it pursues the same process as that bird. The notes of the blackbird are rich and full, but destitute of that varied power of melody which distinguishes the song of the common thrush.—It commences building its nest in March, or the beginning of April; and a thick bush or an ivy-clad tree, is usually the chosen situation. The nest is composed of moss, small sticks, and fibres of root, plastered with mud internally, and afterwards lined with fine dry grass. Here it deposits four or five eggs of a bluish-green colour, blotched with darker variegations. Like the thrush, it is frequently kept in confinement, and may be taught to whistle a variety of tunes, as well as to imitate the human voice.

The periodical visits of the ring-ouzel to our coasts are contrary to others of this genus that migrate, viz. the field-fare, redwing, and common thrush; as it arrives in the spring, and immediately resorts to the mountainous districts of England and Scotland, preferring those of the most stony and barren nature. In these situations it breeds, and rears its young.—The nest is usually placed on some steep bank, supported by a projecting stunted bush, or a tuft of grass or heath: sometimes also in the cleft, or on the shelf of a rock. In form and texture it resembles that of the blackbird, and the eggs are very similar to those of the same bird both in size and colour.—Its song, which it utters perched on the top of some stone or the summit of a rock, is confined to a few clear and powerful notes, not unlike those of the

missel-thrush. Like most of its tribe, it is of a shy disposition, and does not readily admit of a near approach, except during the period when its nest contains unfledged young; at which time it most strenuously endeavours to divert the attention of the intruder by loud cries and feigned gestures. As autumn approaches, it quits its mountainous haunts, journeying southwards; and, about the latter part of October, leaves this kingdom for warmer climates, where it passes the winter. It is common in Sweden, France, and Germany; but according to Temminck, is very rare in Holland.

NOTE B.—*The Starling.*

The starling is widely dispersed through Great Britain, occurring as numerous in the Orkney and Shetland Isles as in the southern parts of the kingdom. Its length is about nine inches. The bill pale yellow, in old birds deep yellow, the nostrils surrounded by a prominent rim; the eyes are hazel brown, and the whole plumage glossed with green, blue, purple, and copper, but each feather is marked at the end with a pale yellow spot; the wing-coverts are edged with yellowish brown; the quill and tail-feathers dusky, with light edges; the legs are of a reddish-brown. Few birds are more generally known than the starling, it being an inhabitant of almost every climate; and as it is a familiar bird, and easily trained in a state of captivity, its habits have been more frequently observed than those of most other birds. In the autumnal and hyemal months, these birds gather in immense flocks, and are particularly abundant in the fenny parts of Nottinghamshire and Lincolnshire, where they roost among the reeds. Before they retire to rest, they perform various manoeuvres in the air, the whole frequently describing rapid revolutions round a common centre. This peculiar flight will sometimes continue for nearly half-an-hour, before they become finally settled for the night. Upon the approach of spring they pair, and spread themselves over the country.

They build in the holes of trees, or in ruinous buildings, making an artless nest of dry grass or hay, on which four or five eggs of a bluish-green colour are deposited.— Their food principally consists of worms and other insects; but they also eat grain and various seeds. According to Mr. Low, they feed in the Orkney Islands, during the severity of winter, upon the sea-louse (*Oniscus marinus*), which they obtain by turning over the small stones on the beach with their bills. The starling is a very imitative bird, and, when tamed, may be taught to articulate very distinctly, and to whistle tunes with much precision. In its wild state even, it may frequently be heard endeavouring to imitate the cries of different birds and animals. Its own peculiar notes are a shrill whistle, and chattering kind of noise. It is found throughout Europe; and the same species appears to be common also in Asia, as I have seen specimens from Nepal that are precisely similar.— The flight of the starling is smooth and even, without any saltatory motion, like the sparrow; and it walks with ease, like the lark, or wagtail, seldom or never using the hopping action of the thrush. These birds are often seen in company with rooks, pigeons, and jackdaws, and I have witnessed a small flock of them associating for a considerable time with a body of lapwings.

At a recent meeting of the Royal Zoological Society of Ireland, the following curious and interesting statement was made respecting large flocks of starlings which roost in the Society's gardens every night:—"There are few people who have not read of the extraordinary congregations of the migratory pigeon in America and of its roosting-places, where it lodges in such vast multitudes each night

as to break down and destroy the mightiest trees of the forest, and where it affords to the neighbouring people, whether Indians or settlers, a valuable store of wholesome food. Now it will scarcely be credited that, for the last three years, if not for a longer period, a nearly similar phenomenon has been in operation every winter within a few hundred yards of Dublin! yet such is the case, and a most interesting one it is. In the mass of thorn-trees at the upper end of the Zoological garden in the Phoenix park sleep every night, from the end of October to about the end of March, from 150,000 to 200,000 birds! This enormous number may appear an exaggeration, yet it is the estimate of many observers. When the birds (starlings) were first observed, they were estimated at from 15,000 to 20,000; but during three years they seem to have increased tenfold. The congregating of these birds is very interesting. If an observer will at dusk place himself near the gold-fish pond, he will perceive starlings, first in twos and threes, coming from every point of the compass into the ivy-tangled thorn; presently large numbers, in flocks, will approach; these seem a little more cautious, and make a partial circuit before they, as it were, drop into their roosts, which they do (garrulous birds as they are on other occasions) in perfect silence. They are scarcely located when some of the main bodies come in sight, consisting of many thousands each: they approach much more slowly than the smaller bodies, and hover and reconnoitre for a considerable time, then all at once drop into their places; there are several of those large bodies, but the largest seems to come from the direction of Lucan. After this detachment (the last of the large ones) has located itself, stragglers only appear, and they come in as long as light enough remains to see them. It is most curious to observe starlings in this case, though so very wary in others, placing themselves absolutely within reach of persons walking under the trees: and it is perhaps not less striking that not one in one hundred of these persons seems to notice them. Great care has been taken to prevent any undue disturbance of the birds in this their resting-place, and it is hoped that any person induced by this statement to observe their roosting will not molest them. The entire silence of the starlings strongly contrasts with the ceaseless noise of a comparatively small number of sparrows, which congregate to sleep in some trees near the bear-pit. A number of blackbirds roost in another part, but they are as nothing compared with the starlings. Field-fares congregate somewhere near the Viceregal lodge, it is believed, as they may be observed flying close to the ground in that direction from various sides, while the starlings are soaring on high towards the Zoological garden. Wilson, or some other American ornithologist, states that on one occasion he heard a sound as of a mighty tempest, and expressed his alarm to a female servant present, who, wondering at his ignorance, replied, 'It is only the pigeons.' She was familiar with the sounds of their wings, as in enormous numbers they sought their resting-places. So it is with us all. The phenomena at a distance, or of rare occurrence, are objects that call forth expressions of wonder, whilst our eyes seem shut to those of even greater interest which are every day occurring in our own neighbourhood. It appears certain that pigeons come from a very great distance to their roosting-places; it is probable that the starlings do so likewise, as it would seem to require a very large circuit to supply the enormous number which congregated in the gardens during the early part of this month."

"The red-winged starlings of America, though generally migratory in the States north of Maryland, are found during winter in immense flocks, sometimes associated with the purple grackles, and often by

themselves, along the whole lower parts of Virginia, both Carolinas, Georgia, and Louisiana, particularly near the sea-coast, and in the vicinity of large rice and corn fields. In the months of January and February," says Wilson, "while passing through the former of these countries, I was frequently entertained with the aerial evolutions of these great bodies of starlings. Sometimes they appeared driving about like an enormous black cloud carried before the wind, varying its shape every moment. Sometimes suddenly rising from the fields around me with a noise like thunder; while the glittering of innumerable wings of the brightest vermillion amid the black cloud they formed, produced on these occasions a very striking and splendid effect. Then descending like a torrent, and covering the branches of some detached grove, or clump of trees, the whole congregated multitude commenced one general concert or chorus, that I have plainly distinguished at the distance of more than two miles; and, when listened to at the intermediate space of about a quarter of a mile, with a slight breeze of wind to swell and soften the flow of its cadences, was to me grand, and even sublime. The whole season of winter, that, with most birds, is past in struggling to sustain life in silent melancholy, is, with the red-wings, one continued carnival. The profuse gleanings of the old rice, corn, and buckwheat fields, supply them with abundant food, at once ready and nutritious; and the intermediate time is spent either in aerial manoeuvres, or in grand vocal performances, as if solicitous to supply the absence of all the tuneful summer tribes, and to cheer the dejected face of nature with their whole combined powers of harmony.

"Before the beginning of September, these flocks have become numerous and formidable; and the young ears of maize, or Indian corn, being then in their soft, succulent, milky state, present a temptation that cannot be resisted. Reinforced by numerous and daily flocks from all parts of the interior, they pour down on the low countries in prodigious multitudes. Here they are seen, like vast clouds, wheeling and driving over the meadows and devoted corn-fields, darkening the air with their numbers. Then commences the work of destruction on the corn, the husks of which, though composed of numerous envelopments of closely wrapt leaves, are soon completely or partially torn off; while from all quarters myriads continue to pour down like a tempest, blackening half an acre at a time; and, if not disturbed, repeat their depredations till little remains but the cob and the shrivelled skins of the grain; what little is left of the tender ear, being exposed to the rains and weather, is generally much injured. All the attacks and havoc made at this time among them with the gun, and by the hawks,—several species of which are their constant attendants,—has little effect on the remainder. When the hawks make a sweep among the *a*, they suddenly open on all sides, but rarely in time to disappoint them of their victims; and, though repeatedly fired at, with mortal effect, they only remove from one field to an adjoining one, or to another quarter of the same enclosure. From dawn to nearly sunset, this open and daring devastation is carried on, under the eye of the proprietor; and a farmer, who has any considerable extent of corn, would require half-a-dozen men at least, with guns, to guard it; and even then, all their vigilance and activity would not prevent a good tithe of it from becoming the prey of the blackbirds. The Indians, who usually plant their corn in one general field, keep the whole young boys of the village all day patrolling around it; and each being furnished with bow and arrows, with which they are very expert, they generally contrive to destroy great numbers of them.

"It must, however, be observed, that this scene

of pillage is principally carried on in the low countries, not far from the sea-coast, or near the extensive flats that border our large rivers; and is also chiefly confined to the months of August and September. After this period, the corn having acquired its hard shelly coat, and the seeds of the reeds or wild oats, with a profusion of other plants, that abound along the river shores, being now ripe, and in great abundance, they present a new and more extensive field for these marauding multitudes. The reeds also supply them with convenient roosting-places, being often in almost unapproachable morasses; and thither they repair every evening from all quarters of the country. In some places, however, when the reeds become dry, advantage is taken of this circumstance, to destroy these birds, by a party secretly approaching the place, under cover of a dark night, setting fire to the reeds in several places at once, which being soon enveloped in one general flame, the uproar among the blackbirds becomes universal; and, by the light of the conflagration, they are shot down in vast numbers while hovering and screaming over the place. Sometimes straw is used for the same purpose, being previously strewed near the reeds, and alder bushes, where they are known to roost, which being instantly set on fire, the consternation and havoc is prodigious; and the party return by day to pick up the slaughtered game. About the first of November, they begin to move off towards the south; though, near the sea-coast, in the states of New Jersey and Delaware, they continue long after that period.

"Such are the general manners and character of the red-winged starling; but there remain some facts to be mentioned, no less authentic, and well deserving the consideration of its enemies, more especially, of those whose detestation of this species would stop at nothing short of total extirpation. It has been already stated, that they arrive in Pennsylvania late in March. Their general food at this season, as well as during the early part of summer, (for the crows and purple grackles are the principal pests in planting time,) consists of grub-worms, caterpillars, and various other larvæ, the silent, but deadly enemies of all vegetation, and whose secret and insidious attacks are more to be dreaded by the husbandman than the combined forces of the whole feathered tribes together. For these vermin, the starlings search with great diligence; in the ground, at the roots of plants, in orchards, and meadows, as well as among buds, leaves, and blossoms; and, from their known voracity, the multitudes of these insects which they destroy must be immense. Let me illustrate this by a short computation; If we suppose each bird, on an average, to devour fifty of these larvæ in a day (a very moderate allowance), a single pair, in four months, the usual time such food is sought after, will consume upwards of twelve thousand. It is believed, that not less than a million pair of these birds are distributed over the whole extent of the United States in summer; whose food being nearly the same, would swell the amount of vermin destroyed to twelve thousand millions. But the number of young birds may be fairly estimated at double that of their parents; and, as these are constantly fed on larvæ for at least three weeks, making only the same allowance for them as for the old ones, their share would amount to four thousand two hundred millions; making a grand total of sixteen thousand two hundred millions of noxious insects destroyed in the space of four months by this single species! The combined ravages of such a hideous host of vermin would be sufficient to spread famine and desolation over a wide extent of the richest and best cultivated country on earth. All this, it may be said, is mere supposition. It is, however, supposition, founded on known and acknow-

ledged facts. I have never dissected any of these birds in spring without receiving the most striking and satisfactory proofs of these facts; and though, in a matter of this kind, it is impossible to ascertain precisely the amount of the benefits derived by agriculture from this, and many other species of our birds, yet in the present case, I cannot resist the belief, that the services of this species, in spring, are far more important and beneficial than the value of all that portion of corn which a careful and active farmer permits himself to lose by it.

"The great range of country frequented by this bird extends from Mexico, on the south, to Labrador. Our late enterprising travellers across the continent to the Pacific Ocean, observed it numerous in several of the valleys at a great distance up the Missouri. When taken alive, or reared from the nest, it soon becomes familiar, sings frequently, bristling out its feathers, something in the manner of the cow-bunting. These notes, though not remarkably various, are very peculiar. The most common one resembles the syllables *conk quer-ree*; others, the shrill sounds produced by filing a saw; some are more guttural, and others remarkably clear. The usual note of both male and female is a single *chuck*. Instances have been produced where they have been taught to articulate several words distinctly; and contrary to what is observed of many birds, the male loses little of the brilliancy of his plumage by confinement.

"A very remarkable trait of this bird is, the great difference of size between the male and the female; the former being nearly two inches longer than the latter, and of proportionate magnitude. They are known by various names in the different states of the Union; such as the *scaup blackbird*, *marsh blackbird*, *red-winged blackbird*, *corn or maize thief*, *starling*, &c. Many of them have been carried from this to different parts of Europe; and Edward relates that one of them, which had no doubt escaped from a cage, was shot in the neighbourhood of London; and on being opened, its stomach was found to be filled with grub-worms, caterpillars, and beetles; which Buffon seems to wonder at, as, 'in their own country,' he observes, 'they feed exclusively on grain and maize.'"

NOTE C.—The American Thrushes.

Of the American song-birds, the thrush genus seems to hold the chief rank, there being at least four species distinguished for their notes, among which is the mocking-bird.

The *Brown thrush*, sometimes called the *Thrasher*, or *French mocking-bird*, is the largest of the genus. His song is loud, emphatic, and full of variety; and, in a serene morning, when the wind is hushed, and before the "busy hum of men" begins, his voice may be distinguished at the distance of half-a-mile. His notes are not imitative, as some have erroneously supposed, but are wholly his own, and bear a very considerable resemblance to those of the European song thrush.

The *Migratory*, or *Red-breasted thrush*, is an early songster, frequently commencing in March, before the snow has disappeared; one or two individuals usually taking the lead, by leaving the flock and perching on a stake or fence, to begin the prelude to the general concert. His song is not a bad imitation of the notes of the preceding, but, though inferior to the brown thrush in execution, it is more simple, and what is deficient in talent is amply made up in zealous enthusiasm; so that his song is universally liked: and he is often, on that account, kept in cages.

The *Wood thrush* is a sweet and solitary songster. He chooses his station, at dawn, on the top of a tall tree, that rises from a low, thick, shaded part of the woods, piping his clear musical notes in a kind of ecstasy, the prelude or symphony to which strongly

resembles the double-tonguing of a German flute, and sometimes the tinkling of a small bell. The whole song consists of five or six parts, the last note of each of which is in a tone that leaves the conclusion suspended. The finale is beautifully managed, with so fine an effect as to appear sweeter and mellower at each successive repetition. Rival songsters, in different parts of a wood, seem to vie with each other in the softness of their tones, and the exquisite finish of their responses. During the heat of the day they are comparatively mute, but they renew their song at the close of day, and continue it long after sunset. Even in dark gloomy weather, during May and June, when scarce a chirp is heard from any other bird, the wood thrush sings from morn till night; and it may be said with justice, that the sadder the day the sweeter is his song. Those who have paid attention to the singing of birds know well that their voice, energy, and expression differ as widely as in man; and, agreeably to this remark, Wilson says he was so familiar with the notes of an individual wood thrush, that he could recognise him from all his fellows the moment he entered the woods.

The *Mocking-bird* seems to be the prince of all song-birds, being altogether unrivalled in the extent and variety of his vocal powers; and, besides the fulness and melody of his original notes, he has the faculty of imitating the notes of all other birds, from the humming-bird to the eagle. Pennant tells us, that he heard a caged one, in England, imitate the mewling of a cat, and the creaking of a sign in high winds. The Hon. Daines Barrington says his pipe comes the nearest to our nightingale of any bird he ever heard. The description, however, given by Wilson, in his own inimitable manner, as far exceeds Pennant and Barrington as the bird excels his fellow-songsters. Wilson tells that the ease, elegance, and rapidity of his movements, the animation of his eye, and the intelligence he displays in listening and laying up lessons, mark the peculiarity of his genius. His voice is full, strong, and musical, and capable of almost every modulation, from the clear mellow tones of the wood thrush to the savage scream of the bald eagle. In measure and accents he faithfully follows his originals, while in force and sweetness of expression he greatly improves upon them. In his native woods, on a dewy morning, his song rises above every competitor, for the others seem merely as inferior accompaniments. His own notes are bold and full, and varied seemingly beyond all limits. They consist of short expressions of two, three, or at most five or six, syllables, generally expressed with great emphasis and rapidity, and continued with undiminished ardour, for half an hour or an hour at a time. While singing, he expands his wings and his tail, glistening with white, keeping time to his own music, and the buoyant gayety of his action is no less fascinating than his song. He sweeps round with enthusiastic ecstasy, he mounts and descends as his song swells or dies away; he bounds aloft, as Bartram says, with the celerity of an arrow, as if to recover or recall his very soul, expired in the last elevated strain. A bystander might suppose that the whole feathered tribe had assembled together on a trial of skill; each striving to produce his utmost effect, so perfect are his imitations. He often deceives the sportsman, and even birds themselves are sometimes imposed upon by this admirable mimic. In confinement he loses little of the power or energy of his song. He whistles for the dog; Caesar starts up, wags his tail, and runs to meet his master. He cries like a burt chicken, and the hen hurries about, with feathers on end, to protect her injured brood. He repeats the tune taught him, though it be of considerable length, with great accuracy. He runs over the notes of the canary, and of the red bird, with such superior execution and effect, that the mortified

songsters confess his triumph by their silence. His fondness for variety some suppose to injure his song. His imitations of the brown thrush are often interrupted by the crowing of cocks; and his exquisite warblings after the blue bird, are mingled with the screaming of swallows, or the cackling of hens. During moonlight, both in the wild and tame state, he sings the whole night long. The hunters, in their night excursions, know that the moon is rising the instant they begin to hear his delightful solo. After Shakspeare, Barrington attributes in part the exquisiteness of the nightingale's song to the silence of the night; but if so, what are we to think of the bird which, in the open glare of day, overpowers and often silences all competition? His natural notes partake of a character similar to those of the brown thrush, but they are more sweet, more expressive, more varied, and uttered with greater rapidity.

The *Yellow-breasted chat* naturally follows his superior in the art of mimicry. When his haunt is approached, he scolds the passenger in a great variety of odd and uncouth monosyllables, difficult to describe, but easily imitated, so as to deceive the bird himself, and draw him after you to a good distance; in such cases his responses are constant and rapid, strongly expressive of anxiety and anger, and while the bird is always unseen, the voice shifts from place to place among the bushes, as if proceeding from a spirit. At first are heard short notes like the whistling of a duck's wings, beginning loud and rapid, and becoming lower and slower, till they end in detached notes. There succeeds something like the barking of young puppies, followed by a variety of guttural sounds, like those of some quadrupeds, and ending like the mewling of a cat, but much hoarser. All those are given with much vehemence, and in different keys, so as to appear sometimes at a great distance, and instantly again quite near you. In mild serene moonlight nights, it continues this ventriloquism all night, responding to its own echoes.

The song of the *Baltimore oriole* is little less remarkable than his fine appearance, and the ingenuity with which he builds his nest. His notes consist of a clear mellow whistle, repeated at short intervals as he gleams among the branches. There is in it a certain wild plaintiveness and *naivete* extremely interesting. It is not uttered with rapidity, but with the pleasing tranquillity of a careless ploughboy, whistling for amusement. Since the streets of some of the American towns have been planted with Lombardy poplars, the orioles are constant visitors, chanting their native "wood notes wild," amid the din of coaches, wheelbarrows, and sometimes within a few yards of a bawling oysterwoman!

The notes of the *Orchard oriole* are neither so full nor so mellow as those of the *Baltimore*, and are uttered more rapidly and gaily, while the bird is flying and carolling in a hurried manner, so that the ear can seldom catch all the tones. Among these there is one note especially which is very striking and interesting. "Almost the whole genus of orioles," says Wilson, "belong to America, and, with a few exceptions, build pensile nests. Few of them, however, equal the *Baltimore oriole* in the construction of these receptacles for their young, and, in giving them, in such a superior degree, convenience, warmth, and security. For these purposes he generally fixes on the high bending extremities of the branches, fastening strong strings of hemp or flax round two forked twigs, corresponding to the intended width of the nest; with the same materials, mixed with quantities of loose tow, he interweaves or fabricates a strong firm kind of cloth, not unlike the substance of a bat in its raw state, forming it into a pouch of six or seven inches in depth, lining it substantially with various soft substances, well interwoven with the outward netting, and, lastly, finishes with a layer

of horse hair; the whole being shaded from the sun and rain by a natural pent-house, or canopy of leaves. As to a hole being left in the side for the young to be fed and void their excrements through, as Pennant and others relate, it is certainly an error: I have never met with any thing of the kind in the nest of the *Baltimore*.

"Though birds of the same species have, generally speaking, a common form of building, yet, contrary to the usually received opinion, they do not build in the same manner. As much difference will be found in the style, neatness, and finishing of the nests of the *Baltimores*, as in their voices. Some appear far superior workmen to others; and probably age may improve them in this, as it does in their colours. I have a number of their nests now before me, all completed, and with eggs. One of these, the neatest, is in the form of a cylinder, of five inches diameter, and seven inches in depth, rounded at bottom. The opening at top is narrowed, by a horizontal covering, to two inches and a half in diameter. The materials are flax, hemp, tow, hair, and wool, woven into a complete cloth; the whole tightly sewed through and through with long horse hairs. This nest was hung on the extremity of the horizontal branch of an apple tree, fronting the south-east, was visible a hundred yards off, though sheltered from the sun; and was the work of a very beautiful and perfect bird. The eggs are five, white, slightly tinged with flesh colour, marked on the greater end with purple dots, and on the other parts with long hair-like lines, intersecting each other in a variety of directions. I am thus minute in these particulars, from a wish to point out the specific difference between the true and bastard *Baltimore*, which Dr. Latham, and some others, suspect to be only the same bird in different stages of colour.

"So solicitous is the *Baltimore* to procure proper materials for his nest, that, in the season of building, the women in the country are under the necessity of narrowly watching their thread that may chance to be out bleaching, and the farmer to secure his young grafts; as the *Baltimore*, finding the former, and the strings which tie the latter, so well adapted for his purpose, frequently carries off both; or, should the one be over heavy, and the other too firmly tied, he will tug at them a considerable time before he gives up the attempt. Skeins of silk and hanks of thread have been often found, after the leaves were fallen, hanging round the *Baltimore's* nest; but so woven up, and entangled, as to be entirely irreclaimable. Before the introduction of Europeans, no such material could have been obtained here; but, with the sagacity of a good architect, he has improved this circumstance to his advantage; and the strongest and best materials are uniformly found in those parts by which the whole is supported. Their principal food consists of caterpillars, beetles, and bugs, particularly one of a brilliant glossy green, fragments of which I have almost always found in the stomach, and sometimes these only."

The *Virginian nightingale*, *Red bird*, or *Cardinal grosbeak*, has great clearness, variety, and melody in his notes, many of which resemble the higher notes of a fife, and are nearly as loud. He sings from March till September, and begins early in the dawn, repeating a favourite stanza twenty or thirty times successively, and often for a whole morning together, till, like a good story too frequently repeated, it becomes quite tiresome. He is very sprightly, and full of vivacity; yet his notes are much inferior to those of the wood, or even of the brown, thrush.

Another bird of this genus, the *Pine grosbeak*, sings extremely clear, mellow, and sweet, though not so loud as birds of its size generally do. A tame one sung, during the months of May and June, with much enthusiasm, for whole mornings together; and

it acquired several notes of the Virginian nightingale, one of which hung near it.

The *American goldfinch*, or *Yellow bird*, sings very much like the European goldfinch; but so weakly, that, even when perched over your head, the notes appear to come from a distance. In a cage he sings with great energy and animation. They are migratory birds; and, when they arrive in spring, great numbers of them assemble on the same tree, to bask and dress themselves in the morning sun, singing in concert, most delightfully, for half-an-hour together.

The *Indigo bird* is fond of perching on fences about road-sides, and is a vigorous and pretty good songster; mounting to the tops of the highest trees, and chanting for half-an-hour at a time. His song is a repetition of short notes, commencing loud and rapid, and falling by imperceptible gradations, till they seem hardly articulate, as if the little minstrel were quite exhausted. After a pause of about half-a-minute, he begins as before. Unlike most other birds, he chants with as much animation under the meridian sun in June as he does in a May morning.

The *Song sparrow* is by far the earliest, sweetest, and most unwearied of the American song-birds, sometimes continuing in song during the whole year. His note, or rather chant, is short but very sweet; somewhat resembling the beginning of the canary's song, frequently repeated for an hour together.

The whole song of the *Black-throated bunting* consists of five, or rather two, notes; the first repeated twice and very slowly, the third thrice and rapidly, resembling *chip-chip, che-che-che*; of which ditty he is by no means parsimonious, but will continue it for hours successively. His manners are much like those of the European yellow-hammer, sitting, while he sings, on palings and low bushes.

The song of the *Rice bird* is highly musical. Mounting and hovering on the wing, at a small height above the ground, he chants out a jingling melody of varied notes, as if half a dozen birds were singing together. Some idea may be formed of it, by striking the high keys of a piano-forte singly and quickly, making as many contrasts as possible, of high and low notes. Many of the tones are delightful, but the ear can with difficulty separate them. The general effect of the whole is good; and when ten or twelve are singing on the same tree, the concert is singularly pleasing.

The *Scarlet tanager* has a pensive monotonous note, like *chip churr*, which appears distant, though the bird be near. At times he has a more musical chant, something like that of the Baltimore oriole. He is none of the meanest of the American songsters, and his plumage renders him a striking ornament to the woodland scenery.

The note of the *Summer red bird* is a strong sonorous whistle, resembling a loose trill, or shake, on the notes of a fife, frequently repeated. That of the female is rather a kind of chattering, like a rapid enunciation of *chickey-tuckey-tuck*.

The *Shore lark* has a single chirp, exactly like the European skylark; and it is reported that, in the country where it breeds, it sings well while mounting in the air.

The *Maryland yellow throat* has a twitter not disagreeable, somewhat like *whitititee*, thrice repeated; after which it pauses for half-a-minute, and begins again the same ditty.

The *Red-eyed flycatcher* has a loud, lively, and energetic song, which is continued sometimes for an hour without intermission. The notes are, in short, emphatic bars of two, three, or four syllables. On listening to this bird, in his full ardour of song, it requires but little imagination to fancy you hear the words, 'Tom Kelly! whip! Tom Kelly!' very distinctly; and hence Tom Kelly is the name given to the bird in the West Indies.

The *White-eyed flycatcher* is a lively, active, sociable, little bird, possessing a strong voice for its size, and a great variety of notes, singing with much vivacity from April to September.

The *Crested titmouse* possesses a remarkable variety in the tones of its voice, at one time not louder than the squeaking of a mouse, and in a moment after whistling aloud and clearly, as if calling a dog, and continuing this dog-call through the woods for half-an-hour together.

The *Red-breasted blue bird* has a soft, agreeable, and often repeated warble, uttered with opening and quivering wings. In his courtship he uses the tenderest expressions, and caresses his mate by sitting close by her, and singing his most endearing warblings. If a rival appears, he attacks him with fury, and, having driven him away, returns to pour out a song of triumph. In autumn his song changes to a simple plaintive note, which is heard in open weather all winter, though in severe weather the bird is never to be seen.

The *Marsh wren* can scarcely be said to sing; but when standing on the reedy banks of the Delaware or Schuylkill in June, you may hear a low crackling sound, as of air-bubbles forcing their way through mud or boggy ground when it is trod upon. These are the singular notes of the marsh wren.

The notes of the *House wren* are loud, sprightly, and tremulous, repeated every few seconds with great animation, with a trilling vivacity extremely agreeable. The European who judges of the song of this species by that of his own wren, will do great injustice to the American bird: for, in strength of tone and execution, the house wren is far superior. He may be heard on the tops of houses, even in towns, singing with great energy.

From these twenty-four examples, it will be seen that the American song-birds, so far from being inferior, are superior, to those of Europe, both in number and the excellence of their music.

The genus *Pitta* of Temminck is composed of birds of very splendid plumage, of a singularly abbreviated form, arising chiefly from the shortness of the tail, whence the name *breves* applied to them by the French. They are in a manner intermediate between the crow and thrush families, having the bill of the former with the feet of the latter. According to Mr. Swainston, they have the gradually curved bill of the true thrushes, but much stronger; the predominant colour of their plumage is green, the sides of the head and the wings being generally variegated with vivid blue; and all are confined to New Holland, and the neighbouring isles of the Indian seas.

CHAP. III.

OF THE NIGHTINGALE, AND OTHER SOFT-BILLED SONG-BIRDS.

THE Nightingale is not only famous among the moderns for its singing, but almost every one of the ancients, who undertook to describe beautiful nature, has contributed to raise its reputation. "The nightingale," says Pliny, "that, for fifteen days and nights, hid in the thickest shades, continues her note without intermission, deserves our attention and wonder. How surprising that so great a voice can reside in so small a body; such perseverance in so minute an animal! With what a musical propriety are the sounds it produces modulated! The note

at one time drawn out with a long breath, now stealing off into a different cadence, now interrupted by a break, then changing into a new note by an unexpected transition; now seeming to renew the same strain, then deceiving expectation! She sometimes seems to murmur within herself: full, deep, sharp, swift, drawling, trembling; now at the top, the middle, and the bottom of the scale! In short, in that little bill seems to reside all the melody which man has vainly laboured to bring from a variety of musical instruments. Some even seem to be possessed of a different song from the rest, and contend with each other with great ardour. The bird overcome is then seen only to discontinue its song with its life."

This most famous of the feathered tribe visits England in the beginning of April, and leaves us in August. It is found but in some of the southern parts of the country, being totally unknown in Scotland, Ireland, or North Wales. They frequent thick hedges and low coppices, and generally keep in the middle of the bush, so that they are rarely seen. They begin their song in the evening, and generally continue it for the whole night.¹ For weeks together, if undisturbed, they sit upon the same tree; and Shakspeare rightly describes the nightingale sitting nightly in the same place, which I have frequently observed she seldom departs from.

From Pliny's description we should be led to believe this bird possessed of a persevering strain; but though it is in fact so with the nightingale in Italy, yet, in our hedges in England, the little songstress is by no means so liberal of her music. Her note is soft, various, and interrupted; she seldom holds it without a pause above the time that one can count twenty. The nightingale's pausing song would be the proper epithet for this bird's music with us, which is more pleasing than the warbling of any other bird, because it is heard at a time when all the rest are silent.²

¹ Some naturalists affirm that there is a part of the night in which nightingales seldom sing; that they are not, according to their name, 'lovers of darkness,' but hail the moonlight or the dawn of day. Others affirm, that they are silent only on dark windy nights, but at other times, having once commenced their song, they continue it without intermission the whole night. "This I know," says Neville Wood, "from actual observation, having more than once remained out of doors nearly the whole night, purposely to discover whether the bird or the naturalist would first be wearied. If on a dark and windy night it does not sing, it may generally be roused by imitating its strains; if this be done on a favourable night, it will commence instantly; but on a cold and chilly night it is sometimes very difficult to rouse, though I have seldom been so unfortunate as to fail entirely. The shutting of an adjoining gate, the striking of a church clock, the passing of a cart or coach, if near a road, or even the hearing passengers walking along the turnpike, will frequently cause it to commence singing!—Ed.

² Hesiod and Oppian notice the variety of its song, calling it the 'various-voiced,' or 'various-

In the beginning of May the nightingale prepares to make its nest, which is formed of the leaves of trees, straw and moss. The nest being very eagerly sought after, is as cunningly secreted; so that but very few of them are found by the boys when they go upon these pursuits. It is built at the bottom of hedges, where the bushes are thickest and best covered. While the female continues sitting, the male at a good distance, but always within hearing, cheers the patient hour with his voice, and, by the short interruption of his song, often gives her warning of approaching danger. She lays four or five eggs; of which but a part in our cold climate come to maturity.

The delicacy, or rather the fame, of this bird's music, has induced many to abridge its liberty, to be secured of its song. Indeed, the greatest part of what has been written concerning it in our country consists in directions how to manage it for domestic singing; while the history of the bird is confined to dry receipts for fitting it for the cage. Its song, however, in captivity, is not so very alluring; and the tyranny of taking it from those hedges where only it is most pleasing, still more depreciates its imprisoned efforts. Gesner assures us, that it is not only the most agreeable songster in a cage, but that it is possessed of a most admirable faculty of talking. He tells the following story in proof of his assertion, which he says was communicated to him by a friend. "Whilst I was at Ratisbon," says his correspondent, "I put up at an inn, the sign of the Golden Crown, where my host had three nightingales. What I am going to repeat is wonderful, almost incredible, and yet is true. The nightingales were placed separately, so that each was shut up by itself in a dark cage. It happened at that time, being the spring of the year, when those birds are wont to sing indefati-

throated' bird; Sophocles refers to its notes as affording an image of vociferous sorrow; and Virgil and Ovid attribute to them a plaintive character. Later poets describe the nightingale as lamenting and complaining, or giving way to despair.

All abandon'd, to despair she sings
Her sorrows through the night.—THOMSON.

Coleridge, however, does not admit that the character of the song is melancholy. He says:

A melancholy bird! Oh! idle thought—
In nature there is nothing melancholy.
But some night-wandering man, whose heart was pierced
With the remembrance of some grievous wrong,
Or slow distemper, or neglected love;
(And so, poor wretch! fill'd all things with himself,
And made all gentle sounds send back the tale
Of his own sorrow;) he, and such as he,
First named these notes a melancholy strain,
And many a poet echoes the conceit.

We have learnt
A different lore: we may not thus profane
Nature's sweet voices, away full of love
And joyance! 'Tis the merry nightingale
That crowds, and hurries, and precipitates,
With fast thick warble his delicious notes,
As he were fearful that an April night
Would be too short for him to utter forth
His love-chant, and disburthen his full soul
Of all its music!

Ed.

gably, that I was so afflicted with the stone, that I could sleep but very little all night. It was usual then about midnight, when there was no noise in the house, but all still, to hear the two nightingales jangling and talking with each other, and plainly imitating men's discourses. For my part, I was almost astonished with wonder; for at this time, when all was quiet else, they held conference together, and repeated whatever they had heard among the guests by day. Those two of them that were most notable, and masters of this art, were scarcely ten feet distant from one another. The third hung more remote, so that I could not so well hear it as I lay a-bed. But it is wonderful to tell how those two provoked each other; and by answering, invited and drew one another to speak. Yet did they not confound their words, or talk both together, but rather utter them alternately and of course. Besides the daily discourse of the guests, they chanted out two stories, which generally held them from midnight till morning; and that with such modulations and inflections, that no man could have taken to come from such little creatures. When I asked the host if they had been taught, or whether he observed their talking in the night, he answered, no: the same said the whole family. But I, who could not sleep for nights together, was perfectly sensible of their discourse. One of their stories, was concerning the tapster and his wife, who refused to follow him to the wars, as he desired her: for the husband endeavoured to persuade his wife, as far as I understood by the birds, that he would leave his service in that inn, and go to the wars in hopes of plunder. But she refused to follow him, resolving to stay either at Ratisbon, or go to Nuremberg. There was a long and earnest contention between them; and all this dialogue the birds repeated. They even repeated the unseemly words which were cast out between them, and which ought rather to have been suppressed and kept a secret. But the birds, not knowing the difference between modest, immodest, honest, and filthy words, did out with them. The other story was concerning the war which the emperor was then threatening against the Protestants; which the birds probably heard from some of the generals that had conferences in the house. These things did they repeat in the night after twelve o'clock, when there was a deep silence. But in the daytime, for the most part they were silent, and seemed to do nothing but meditate and revolve with themselves upon what the guests conferred together as they sat at table, or in their walks. I verily had never believed our Pliny writing so many wonderful things concerning these little creatures, had I not myself seen with my eyes, and heard them with my ears uttering such things as I have related. Neither yet can I of a sudden write all, or call to remembrance every particular that I have heard."

Such is the sagacity ascribed to the nightingale: it is but to have high reputation for any one quality, and the world is ready enough to give us fame for others to which we have very small pretensions. But there is a little bird, rather celebrated for its affection to mankind than its singing, which, however, in our climate, has the sweetest note of all others. The reader already perceives that I mean the REDBREAST, the well-known friend of man, that is found in every hedge, and makes it vocal. The note of other birds is louder, and their inflections more capricious, but this bird's voice is soft, tender, and well-supported; and the more to be valued, as we enjoy it the greatest part of the winter. If the nightingale's song has been compared to the fiddle, the redbreast's voice has all the delicacy of the flute.

The redbreast, during the spring, haunts the wood, the grove, and the garden; it retires to the thickest and shadiest hedgerows to breed in. But in winter it seems to become more domestic, and often to claim protection from man. Most of the soft-billed birds, the nightingale, the swallow, and the titmouse, leave us in the winter, when their insect food is no longer offered in plenty; but the redbreast continues with us the year round, and endeavours to support the famine of winter by chirping round the warm habitations of mankind; by coming into those shelters where the rigour of the season is artificially expelled, and where insects themselves are found in greater numbers, attracted by the same cause.

This bird breeds differently in different places: in some countries its nest is usually found in the crevice of some mossy bank, or at the foot of a hawthorn in hedgerows; in others it chooses the thickest coverts, and hides its nest with oak-leaves. The eggs are from four to five, of a dull white, with reddish streaks.

The Lark, whether the sky-lark, the wood, or the tit lark, being all distinguishable from other little birds by the length of their heel, are louder in their song than either of the former, but not so pleasing. Indeed the music of every bird in captivity produces no very pleasing sensations; it is but the mirth of a little animal insensible of its misfortunate situation: it is the landscape, the grove, the golden break of day, the contest upon the hawthorn, the fluttering from branch to branch, the soaring in the air, and the answering of its young, that gives the bird's song its true relish. These, united, improve each other, and raise the mind to a state of the highest, yet most harmless, exultation. Nothing can in this situation of mind, be more pleasing than to see the lark warbling upon the wing; raising its note as it soars, until it seems lost in the immense heights above us; the note continuing, the bird itself unseen; to see it then descending with a swell as it comes from the clouds, yet sinking by degrees as it approaches its nest, the

spot where all its affections are centered, the spot that has prompted all this joy.

The lark builds its nest upon the ground, beneath some turf that serves to hide and shelter it. The female lays four or five eggs, of a dusky hue in colour, somewhat like those of a plover. It is while she is sitting that the male thus usually entertains her with his singing; and while he is risen to an imperceptible height, he still has his loved partner in his eye, nor once loses sight of the nest, either while he ascends or is descending. This harmony continues several months, beginning early in the spring on pairing. In winter they assemble in flocks, when their song forsakes them, and the bird-catchers destroy them in great numbers for the tables of the luxurious.³

The black-cap⁴ and the wren, though so very diminutive, are yet prized by some for their singing. The former is called by some the mock nightingale; and the latter is admired for the loudness of its note, compared to the little body from whence it issues. It must be confessed, that this disproportion between the voice of a bird and its size, in some measure demands our wonder. Quadrupeds in this respect may be considered as mutes to them. The peacock is louder than the lion, and the rabbit is not so loud as the wren. But it must be considered, that birds are very differently formed; their lungs are in some measure extended through their whole body, while in quadrupeds they lie only in the breast. In birds there are a variety

of cells which take in the air, and thus pour forth their contents at the little animal's command. The black-cap and the wren, therefore, are as respectable for their voices as they might be deemed inconsiderable for their size.⁵

All these soft-billed birds, thus prized for their singing, are rendered domestic, and brought up with assiduity by such as are fond of their voices in a cage. The same method of treatment serves for all, as their food and their habits are nearly the same. The manner of taking and treating them, particularly the nightingale, is this: A nightingale's nest may be found by observing the place where the male sings, and then by sticking two or three meal-worms (a kind of maggot found in flour) on some neighbouring thorn, which when he sees he will infallibly bear away to his young. By listening, he then may be heard with the female chirping to the young ones while they are feeding. When the nest is found, if the young ones are not fledged enough to be taken, they must not be touched with the hands, for then the old ones will perceive it, and entice them away. They should not be taken till they are almost as full of feathers as the old ones; and, though they refuse their meat, yet, by opening their bills, you may give them two or three small bits at a time, which will make them soon grow tame, when they will feed themselves. They should be put, nest and all, into a little basket, which should be covered up warm; and they should be fed every two hours. Their food should be sheep's hearts, or other raw flesh-meat, chopped very fine, and all the strings, skins, and fat, taken away. But it should always be mixed with hard hens' eggs, upon which they will feed and thrive abundantly.

They should then be put in cages like the nightingale's back cage, with a little straw or dry moss at the bottom; but when they are grown large, they should have ants' mould. They should be kept very clean, as indeed should all singing-birds whatsoever; for otherwise they will have the cramp, and perhaps the claws will drop off. In autumn they will sometimes abstain from their food for a fortnight, unless two or three meal-worms be given them twice or thrice a-week, or two or three spiders in a day; they must likewise have a little saffron in their water. Figs chopped small among their meat will help them to recover their flesh. When their legs are cramped, they should be anointed with fresh butter, or capon's fat, three or four days together. If they grow melancholy, put white sugar-candy into their water, and feed them with sheep's heart, giving them three or four meal-worms in a day, and a few ants with their eggs.

With regard to adult birds, those that are taken before the twenty-third of April are accounted the best, because after that they begin to pair. They usually haunt woods, coppices,

³ See Supplementary Note A, p. 138.

⁴ This bird is somewhat above five inches in length. The upper mandible is of a dark horn colour; the under one a light blue, and the edges of both whitish: top of the head black; sides of the head and back of the neck ash colour; back and wings of an olive gray; belly and vent white: the legs are of a bluish colour, inclining to brown; the claws black. The head of the female is of a dull rust colour. The black-cap visits us about the middle of April, and retires in September; it frequents gardens, and builds its nest near the ground: it is composed of dried grass, moss, and wool, and lined with hair and feathers. The female lays five eggs, of a pale reddish brown, sprinkled with spots of a darker colour. During the time of incubation the male attends the female, and sits by turns; he likewise procures her food, such as flies, worms, and insects. The black-cap sings sweetly, and so like the nightingale that in Norfolk it is called the mock nightingale. Buffon says, that its airs are light and easy, and consist of a succession of modulations of small compass, but sweet, flexible and blended. And our ingenious countryman, Mr. White, observes that it has usually a full, deep, sweet, loud, and wild pipe; yet the strain is of short continuance, and its motions desultory. But when the bird sits calmly, and in earnest engages in song, it pours forth very sweet, but inward melody, and expresses great variety of sweet and gentle modulations, superior, perhaps, to any of our warblers, the nightingale excepted; and while it warbles, its throat is wonderfully distended. Black-caps feed chiefly on flies and insects, and not unfrequently on ivy and other berries. —ED.

⁵ See Supplementary Note C, p. 139.

and quickset hedges, where they may be taken in trap-cages baited with meal-worms. They should be placed as near the spot where the bird sings as possible; and before you fix the trap, turn up the earth twice the breadth of the cage, because they will there look for food. They are also taken with lime twigs, placing them upon the hedge where they usually sing; and there should be meal-worms stuck at proper places to draw them into the snare. After they are taken, their wings should be gently tied with thread, to prevent their beating themselves against the cage. This should be first hung in a private place, that the bird may not be disturbed; and it should be fed every two hours, at farthest, with sheep's heart and egg minced very fine, mixing it with meal-worms. However, the first food must be worms, ants, caterpillars, and flies. You must, to feed the bird, take it in your hand, and open the bill with a stick made thick at one end, giving it the insects, or four or five bits of food as big as peas, to entice it to eat. Its common food should be mixed with ants, so that when the bird goes to pick up the ants, it may pick up some of that also. The nightingale, when caged, begins to sing about the latter end of November, and continues its song till June.

NOTE A.—*The Lark family.*

The *Crested-lark*, so called from the tuft with which its head is surmounted, is more bulky than the common lark. The bill is longer, and the wings and tail shorter. The wings, when folded, come to about half the length of the tail. Feathers of a deep gray, with an edging of a lighter tint, cover the head, and upper part of the neck and body. On each side of the head is a band of reddish gray interrupted by the eye. The lower parts are of an obscure white, slightly tinted with reddish. The head is more thick, and the bill stronger, in the male than in the female, and it has more black on the breast. Both have the tongue wide, and a little forked. Without being so common as the sky-lark, the crested-lark is pretty well spread throughout Europe, from Russia to Greece. It seems very doubtful whether it is ever found in this country. It neither flies in flocks like the common lark, nor rises so high; and it continues in flight a longer time without alighting. It is by no means wild, nor does it dread the appearance of man, but commences to sing at his approach. The males sing infinitely better than the females, and their voice is very sweet and agreeable. During fine weather there is no cessation to their strains; but they become silent when the sky is overcast, and rain descends; they forget their gaiety and their music until the re-appearance of a brilliant sun re-animates their vivacity. They usually sing until the month of September. In captivity they also sing, and retain more readily the airs which are taught them from the bird-organ, than almost any other bird. But they seldom survive the loss of their liberty, and it requires much care and difficulty to preserve them any time in cages. The female places her nest on the ground, like the common species. She lays twice a-year, about four or five eggs of a clear ash-colour, thick set with brown and blackish spots.

The *Wood-lark* has been confounded by ornithologists with the crested lark, on account of the similar tuft with which its head is surmounted. It is smaller

than the crested-lark, and the tuft can hardly be considered as a genuine one, being only a little greater elongation of the feathers of the head than in the common lark. The male is more frequently observed to elevate these than the female. This lark is found in Germany, France, Holland, Siberia, Poland, and Italy. When these birds perch they sing agreeably. They are heard to warble in great numbers together, in the commencement of spring; but when these assemblages disperse in amorous couples, the male then displays all his vocal powers, and produces very melodious sounds, especially after sunset. Thus he soothes and charms his mate, engaged in her maternal cares. From the time the young family bursts the shell, the sire takes his share in their education; but his songs are over, for the love which created his melody is at an end.

In many respects, both of habit and appearance, these birds differ from the *Sky-lark*. They perch as well in trees as on the ground; but this they do only on the largest branches, where they are able to secure their hold with positively embracing the stems with their toes. The sky-lark forms its nest amongst grass or corn; and the wood-lark usually at the foot of a bush, near the bottom of a hedge, or it lays where the grass is rank and dry. The fabric is of loose texture, and constructed of withered herbs and fibrous roots, with a few horse-hairs in the inside.

The *Short-toed lark* is met with in the Canaries, in the southern provinces of France, and especially in Champagne, where the species is remarkably numerous. These larks arrive in the last-mentioned country about the end of April, and are universally found in dry and sandy situations. They have several broods, and the first takes place soon after their arrival. The nest is constructed on the ground, of few materials, principally the blades of dog's grass, and is usually found in a wheel-rut, or track of a horse's hoof. The eggs are three or four, gray in colour, and spotted with a brownish gray, which spots are more confluent towards the gross end. As soon as the young can manage for themselves, they quit the untilled lands of Champagne, unite in numerous bodies, and seek fresher abodes and oaten fields. They leave this province at the end of August, and do not return until the following spring. Morning and evening, all the males of the plain assemble, and at a very elevated height in the air, produce a concert, which is heard very distinctly, even though the birds are out of sight. This song is more agreeable and melodious than that of the common lark. They seldom sing in the middle of the day, and never on the ground, but utter then a peculiar sort of cry. This lark can run with the rapidity of a field mouse, especially when disturbed, and on the point of taking to flight. All the larks are pulverating birds; but this one is so particularly attached to powdering itself with dust, that, on being supplied with some in a state of captivity, it will immediately testify its joy by a little soft cry, frequently repeated, and by precipitate movements of the wings, and bristling of all the feathers. It will plunge instantly into sand or ashes, as other birds do into water, remains there a long time, wallowing in all sorts of ways, and does not come out of it until it is so covered with it, that its plumage is scarcely to be distinguished.

The *Clapper lark* is a native of South Africa. It usually makes its nest in some small grass, and lays from four to five eggs, of a greenish-gray. It seldom rises more than from fifteen to twenty feet above the ground, and makes a particular noise, occasioned by the precipitate motion of its wings, which is heard at a great distance. When in the season of its amours it rises to the height above mentioned, it utters a cry resembling the syllables *pi-wit*, the last syllable of which is elongated during its descent. It

descends with the wings closed, and in an oblique line to the earth, where it rests scarcely half a minute, and then rises again. It sings in the morning, in the evening at sunset, and for most part of the night.

The *Red-backed lark* chiefly delights in plains abounding with bushes. It perches readily on these, and even on the trees which are at the edges of woods. Its song is agreeable.

The *Alpine lark* inhabits the most northern portions of the two continents. In both quarters of the globe these larks, whose flesh is wholesome food, though without flavour, like that of most American birds, quit their winter retreat in the early days of spring, to withdraw into the countries which are nearest to the pole, where, in perfect security from the aggressions of man, they may deliver themselves without disturbance to the education of their young families.

The *Calandre* is larger than the common lark, but yet has many points of resemblance to it, not only in conformation and colour, but also in habits and manners. Its voice is equally agreeable, but stronger; it possesses a similar levity of motion and disposition; it nestles in the same manner on ground, under a clump of tufted grass, and lays four or five eggs. It has a similar facility of counterfeiting perfectly the song of many birds, and the cries of some quadrupeds, but its species is less numerous. It is found in the south of France, particularly in Provence, where it is common, and generally reared on account of its song; it is also found in Italy and the island of Sardinia, where it passes the entire year. The *calandres* are not observed to congregate in flocks, but usually remain single; in autumn they grow very fat, and are then good eating; they are taken in nets, laid near the waters where they are accustomed to drink.

The *Sirli*, a species of lark, is remarkable for its long and arched beak. It is found in the southern parts of Africa, and even in Barbary, usually inhabiting the sandy downs; from its peculiar song, which it generally puts forth from some little eminence, its name is derived.

The *Double-crested lark* is distinguished chiefly by the double crest, from which its name is derived.

NOTE B.—The Titmice family.

The majority of the *Titmice*, particularly those which frequent woods, thickets, and orchards, are courageous, and even ferocious; they will attack the owl with greater boldness than any other bird, being always foremost in darting on him, and trying to pick out his eyes. They express their little rage and fury by the swelling of their plumes, by violent attitudes, and precipitate motions; they peck sharply the hand which holds them, strike it repeatedly with the bill, and seem by their cries to call others to their assistance, which usually attracts them in crowds, and produces abundant sport to the fowler, for a single individual can take them all. There are many traits of conformity in their manners and disposition with those of the crows, shrikes, and pies; they have the same appetite for flesh, and the same custom of tearing their food in pieces to eat it. These birds being of a lively and active character, are incessantly in motion; they are continually fluttering from tree to tree, hopping from branch to branch, climbing up the trunk, crooking themselves to walls, and suspending themselves in all fashions, sometimes with the head downwards. Though fierce, they are social, seek out the company of their own species, and form little flocks, more or less numerous; and if any accident should separate them, they recall each other mutually, and are soon reunited. They then seek their food in common, visit the clefts

of rocks and walls, and tear with their bills the lichens and the moss of trees, to find insects or their eggs. They also feed on seeds; but though in many species the bill is strong enough, they do not break them, like the bullfinches and linnets; they place them under their claws, and pierce them with their bills like the nuthatches, with which they sometimes seem to associate during the winter. If a nut be suspended at the end of a string, they will hook themselves to it, and follow all its oscillations without letting go, and keep incessantly pecking at it. Such manœuvres indicate much strength in the muscles; it has accordingly been observed that the bill is moved by very robust and vigorous muscles and ligaments, as well as the neck, and that the cranium is remarkably thick. They will eat not only grains, but insects, as above hinted, and butterfly-eggs, and peck the growing buds. The largest species (the great titmouse) joins to its other aliments bees, and even little birds, if it finds them enfeebled by illness, or entangled in snares, but it usually eats only the head. Almost all the species of titmice are very productive, even more so than any other birds, in proportion to their size; their brood is said sometimes to consist of eighteen or twenty eggs. Some make their nests in the trunks of trees, others on shrubs, and give it the form of a ball, of a volume greatly disproportioned to their size; some suspend it at the end of a branch, in reeds or rushes. The materials which they employ are small plants, little roots, moss, flax, cattle hair, wool, the down of plants, cotton, and feathers; they tend their numerous family with the most indefatigable zeal and activity, are very much attached to it, and defend it with courage against the birds which attack it. They rush on the enemy with such intrepidity as to force him to respect their weakness. The titmice are extended over the Old continent, from the north to the south of Europe, through Africa, India, and China: they are also found in North America, but are as yet unknown in the southern part of that continent. Within a few years, several have been discovered in New Holland.

Among the titmice, those which are most easily caught in snares, &c. are the *Great*, the *Black*, and *Blue-headed* species; the *Crested*, the *Long-tailed*, the *Bearded*, and the *Penduline* are not so easily managed. There are plenty of modes employed, with success, for the destruction of these little birds, the details of which would involve but little interest for our readers. Those who keep bees are very sufficiently justified, however, in destroying the titmice, as the latter wage a very cruel war upon these useful insects, particularly when they have young ones.

NOTE C.—The Wrens.

Modern naturalists have restricted the wren genus to such birds as have a slender, slightly compressed, curved, and marginated bill, with the nostrils basal, and half-covered by a naked membrane; the wings are short and rounded, with the fourth and fifth feathers of equal length, but longer than the others, the tail short, rounded, and erect, and the tarsus the same length as the middle toe. The birds of this genus are subject to a wide geographical distribution; although there is but one species in Europe, which is common to all its kingdoms.

The *Winter wren* (*Troglodytes hyemalis*) is a native of North America, and visits the United States in the month of October, where it generally remains all winter, and migrates to the north in spring, to fulfil the important law of incubation. In its general appearance it has a strong resemblance to the European wren; and some naturalists have considered it as of the same species. It sings with great anima-

tion while mounted on the point of some branch of a tree. It is by no means a shy bird, as it is to be found in out-houses, yards, and gardens, in different cities of the Union.

The *House wren* (*T. Oedon*) is migratory; it arrives in Pennsylvania about the middle of April, and begins to construct its nest in the second week of May. It is customary for the natives to place a small box on the top of a pole in the garden for its reception; and if this be neglected, it will take possession of a hole in the roof or wall, and has even been known to breed in an old hat. The conjugal pair generally hatch two broods in a season,—the one in June, and the other in the end of July.

The *Common wren* (*Anorthura troglodytes*) is one of the most familiarly known of our small birds, being rendered remarkable by its peculiar form, not less than by the liveliness of its motions. Next to the robin, it is perhaps the least liable to molestation from boys and idle people; and for this security it is indebted partly to its small size, and partly to its cheerfulness and innocence. Next to the kinglets, the creeper, the chiff-chaff, and the smaller tits, it is the least of our native birds. Its flight is effected by a rapid and continuous motion of the wings, and therefore is not undulated, but direct; nor is it sustained, for the bird merely flits from one bush to another, or from stone to stone. It is most frequently met with along stone walls, among fragments of rocks, in thickets of whins, and by hedges, where it attracts notice by the quickness of its motions, and frequently by its loud chirring noise. When standing, it keeps its tail nearly erect, and jerks its whole body smartly; then hops about with great alacrity, using its wings at the same time, and continually enunciating its rapid chit. In spring and summer the male has a very pleasing, full, rich, and mellow song, which it repeats at short intervals; and even in autumn, and on fine days in winter, it may occasionally be heard hurrying over its ditty, the loudness and clearness of which, as proceeding from so diminutive a creature, is apt to strike one with surprise even after it has long been familiar to him. During the breeding season, wrens keep in pairs often in unfrequented parts, such as bushy dells, mossy woods, the banks of streams, and stony places overgrown with brambles, sloes, and other shrubs; but towards the end of autumn they approach the habitation of man, and although never decidedly gregarious, sometimes appear in small straggling parties. They are not, properly speaking, shy, as they conceive themselves secure at the distance of twenty or thirty yards, but, on the approach of a person, conceal themselves in holes among stones, or among the roots of bushes. In liveliness and activity the wren rivals the kinglets, tits, and creeper, as might be expected from its diminutive size, birds as well as quadrupeds being generally more slow in their motions the larger their bulk.

A pleasant little fable, of which the wren is the hero, is told by the Hebridiens. At an assembly of the birds, the eagle was boasting of his strength, asserting that he could mount higher in the air than any of earth's inhabitants, when up starts the little wren, and flatly contradicts the tyrant, challenging him to a trial of speed. The eagle regarded his puny rival with contempt, but accepting the challenge, or desirous of displaying his power, spread out his huge wings, and launched into the air. Up rose the royal bird in majestic gyrations, over the assembled tribes, up beyond the mountain tops, up beyond the streaks of gray vapour, up beyond the specks and lines of the white cirri and cirrocumuli that floated in the blue ocean of ether, up until he seemed but a point in the eye of the goshawk and peregrine, who watched his progress with more envy than admiration, and of the raven, who thought he could mount

as high himself; still up until he vanished entirely from the sight of most of the other birds, who were not accustomed to look so far into the sky. But where was the little wren all this time? Had he crept with shame into some hole, or been unwittingly trampled to death by the broad foot of some gazing gander, or the still broader foot of the pillar-legged pelican? At length the eagle stopped, gasping for breath, with swollen eyes and palpitating heart, unable to ascend a foot farther, and spreading wide his wings and tail, floated in the dazzling light. The little vain-glorious thing that had defied him, he knows has been left at least a mile behind. But lo! up again starts the wren, who had nimbly perched on the eagle's back, and kept himself concealed among the feathers. With a hop, and a jerk of his tail, and a glance of pride, up springs the little wren into the region of vacuity, and, fluttering there for a moment, sings his song of triumph. The eagle cast a glance of mortified pride upon him, which he heeded not, but seizing a feather of his rival's neck, descended in safety to the ground, to receive the prize impartially adjudged by the astonished conclave. The moral of the fable is, that cunning may supply the lack of power.

The kinglets formerly ranked among the wrens, but Cuvier, following Ray, formed a new genus for their reception under the title of *Regulus*. They subsist almost entirely on insects, in the pursuit of which they exhibit great nimbleness of action. They construct their nest with much neatness. The British species usually suspend them to the extreme branch of a tree, and cover them externally with mosses, selecting the same kind which is on the tree for their purpose.

The *Ruby-crowned kinglet* (*Regulus calendula*) is a native of North America. They are birds of passage, and visit the United States from the south, about the beginning of April. Their food at this season consists of the blossoms of the maple tree, and when these fail, they have recourse to those of the peach, apple, and other fruit trees. They eat only the stamens of these flowers, but they also subsist upon the insects which hover round them. These birds penetrate far to the north, and even build and incubate in the country around Hudson's bay. The ruby-crowned kinglet is only four inches long, and six in extent of wings.

The *American kinglet* seems to be confounded by Wilson and other naturalists with the European kinglet, from which it differs in several essential particulars. The length of the American *Regulus* is three inches and seven-eighths, while the European species varies from three inches and a half to three inches and three quarters; the bill is also longer, and more dilated at the base, and the crest differs materially. The American kinglet is an active, unsuspicious bird, climbing and hanging occasionally among the branches, and sometimes even on the body of the tree, in search of the larvæ of insects. It also retires northwards to incubate, and is seldom to be met with in the State of Pennsylvania from May to October; after which it becomes very abundant in orchards, and assists greatly in thinning them of the numerous insects with which they are infested at this time of the year. It is four inches long, and six in extent.

The *All-Coloured kinglet* (*R. omnicolor*) is a native of Brazil, and inhabits the extensive forests which border the Rio-Grande. It is remarkable for the brilliancy of its plumage; and differs from its congeners in being provided with an ample tuft of feathers on the crown of the head; its bill differs, also, in being somewhat straighter.

The *European kinglet* (*R. cristatus*) is to be met with all over Europe, and is plentiful in some parts of this island. It is a resident with us the whole

year round; but Selby records two instances where it migrated; in October 1822 and January 1823. In the latter case, the whole tribe disappeared. This happened a few days prior to the long-continued snow-storm, so severely felt through the Northern counties of England, and along the Eastern parts of Scotland. It is the smallest British bird, being only three inches and three quarters in length, and seldom exceeds sixty grains in weight. It is commonly known by the name of 'The Golden-crested Wren.' It has an exceeding beautiful small row of feathers on the top of the head, of a gold or orange colour, which it has a power of drawing together, in such a manner as entirely to conceal the little crest, by laying the feathers all flat upon the head; and likewise to raise them at pleasure. The form of them is long, as they take their rise from the base of the bill, and extend themselves to the back of the head, on each of which there runs a black line. The eyes are encircled with white; the sides of the neck of a fine, shining, yellowish green; the breast of a dusky white; the back is of a greenish colour, with a mixture of yellow. The quill feathers of the wings are of a dusky brown, with some of their edges yellow, others white; the tips of some of those next to the covert feathers are also white; and the tips of some of the coverts being of the same colour, form a white line across the wing. The tail is of a dusky colour, about an inch and a half long, with some of the edges of the feathers of a yellowish green; the feet and claws are pretty near of the same colour.

NOTE D.—*The Warblers, Chats, and Wagtails.*

The Warblers are very numerous, and are widely diffused in their geographical range. They feed chiefly on insects and their larvæ, and subsist occasionally on fruits. They are migratory in all countries where they are found, passing to the warmer regions during winter, in quest of insect food, and returning to more northern latitudes as the summer advances, for the purpose of incubation. The colours of the plumage in most of the species, consist of strong and decided contrasts of green, yellow, and black. Nearly the whole species of this extensive genus are songsters.

The *Palm warbler* (*Sylvia palmarum*) is an inhabitant of St. Domingo, and other West India islands, extending its migrations to South Carolina and Philadelphia, in the United States. Its food consists of insects, fruits, and small seeds. It builds its nest on the very top of some lofty palm tree, from which it takes the name of 'the Palmist.' Its song is limited to five or six notes, and is full, soft, and mellow, although consisting of little variety. There is no difference in the form or hues of the male and female, but the winter plumage is more dull than the summer garb.

The *Blue-mountain warbler* (*S. tigrina*) inhabits the lofty American range of alpine scenery, whose name it bears, seldom descending from the airy heights and gloomy silence of those dreary fastnesses. It is four inches and three quarters in length, and its song is merely a feeble screech, three or four times repeated. Its food consists chiefly of insects. It is not yet known whether there be any difference of colour between the male and female.

The *Hemlock warbler* (*S. parus*) was discovered by Wilson in the Great Pine Swamp of Pennsylvania. It is an active and lively bird, climbing and hanging among the twigs like a titmouse. Its song consists of a few sweet notes, which it never utters while in motion, always singing while in a quiescent state. In pursuit of insects its usual habit is to commence at the foot of a tree, and hunt, with much spirit and vigour, every branch as it ascends.

The *Pensile warbler* is nearly five inches long.

The bill is dusky; the head grayish black; and the back deep gray. Round the eye there is a white streak; and between that and the bill a range of yellow dots. The throat, neck, and breast, are yellow. The belly is white; and the sides of the neck and body are dotted with black spots. The wing coverts are white and black, in bands. The tail is dark gray, having the four outer feathers marked with large spots of white. The sagacity of this bird, in building and placing its nest, is truly remarkable. She does not fix it at the forking of the branches, as is usual with most other birds, but suspends it to binders hanging from the netting which she forms from tree to tree, especially those which fall from branches that hang over the rivers and deep ravines. The nest consists of dry blades of grass, the ribs of leaves, and exceedingly small roots, interwoven with the greatest art; it is fastened on, or rather it is worked into, the pendant strings. It is, in fact, a small bed rolled into a ball, so thick and compacted as to exclude the rain; and it rocks in the wind without receiving any harm. But the elements are not the only enemies against which this bird has to struggle; with wonderful sagacity it provides for the protection of its nest from other accidents. The opening is neither made on the top nor side of the nest, but at the bottom: nor is the entrance direct. After the bird has made its way into the vestibule, it must pass over a kind of partition, and through another aperture, before it descends to the abode of its family. This lodgment is round and soft, being lined with a species of lichen, which grows on the trees, or with the silky down of plants. The birds of this species have a very delicate song, which is continued throughout the year. They are natives of St. Domingo, and some others of the West Indian Islands, where they feed chiefly upon insects and fruit.

The *Superb warbler* is a very elegant bird, and though it has no variety of colours, it is possessed of considerable beauty. The upper part of the body is blackish-blue, and white beneath; the feathers of the head are long, lax, and turgid; from the base of the bill to the middle of the head rise some beautiful blue feathers, which give it a crested appearance: on the cheeks, and extending a considerable way down the neck, is a patch of this fine blue. The head, throat, and as far as the middle of the back, is of a deep black; the bill and ocular bands are black; two quill feathers are brown; the tail is wedge-shaped; and the legs of a pale brown. The female is brown above, white beneath; and blue round the eyes. The superb warbler is five inches and a half long, and inhabits New Holland.

The *Chat* genus—which embraces the White-ear, the Stone-chat, and the Whin-chat—are all common in Europe, and frequent moors and other open wastes. They live solitary, or in pairs, and are wild in disposition. They run with much celerity, and their food consists of insects and worms, which they take chiefly upon the ground.

The *White-ear* is a handsome bird, but of a wild and timid nature. It is migratory, and arrives in Britain about March. On its appearance, it is esteemed a great delicacy, and numbers are annually caught for the table.

The *Stone-chat* is not migratory, but resides in Britain throughout the year. It generally selects the bottom of a whin or other bush for its nest, which is composed of moss or dry grass, lined with hair or feathers.

The *Whin-chat* is somewhat larger than the stone-chat. Its bill is black; eyes hazel; the feathers on the head, neck, and back, are black edged with rust colour; a streak of white passes from the bill over each eye towards the hinder part of the head; the cheeks are blackish; chin white; the breast is of a rust colour; belly, vent, and thighs, pale buff; each

wing is crossed by a white mark near the shoulder, and another smaller near the bastard wing; part of the tail at the base is white, the rest black: the two middle feathers are wholly black, as are also the legs. The colours in general of the female are paler: the white streak over the eye, and the spots on the wings, are much less conspicuous; and the cheeks, instead of being black, partake of the colours of the head. The whin-chat is a solitary bird, frequenting heaths and moors: it has no song, but only a simple unvaried note; and in manners very much resembles the stone-chat. It makes its nest very similar to that bird, and is generally seen in the same places during the summer months. The female lays five eggs of a lightish blue, very faintly sprinkled with small rusty spots. In the northern parts of England it appears in winter; but its migration is only partial, as it is seen in some of the southern counties at the same season. It feeds on worms, flies, and insects. About the end of summer it is very fat, and at that time is said to be scarcely inferior in delicacy to the ortolan.

The *Winter fauvette*, a well-known bird, is somewhat more than five inches. Its bill is dark; eyes hazel; its general appearance is that of a dusky brown; the feathers of the head, hinder part of the neck, back, wings, and tail, are edged with rusty or pale tawny brown, plain on the rump, rather clouded on the breast, and dashed on the sides with deeper shades of those colours; the chin, throat, sides of the neck, and fore part of the breast, are of a dull bluish ash; the belly is of the same colour, but lighter; and the legs are reddish brown. This bird is frequently seen in hedges, from which circumstance it derives one of its names; but it has no other relation to the sparrow than in the dinginess of its colours; in every other respect it differs entirely. It remains with us the whole year, and builds its nest near the ground; it is composed of moss and wool, and lined with hair. The female generally lays four or five eggs, of a uniform pale blue, without any spots; the young are hatched about the beginning of May. During the time of sitting, if a cat or other voracious animal come near the nest, the mother endeavours to divert it from the spot by a stratagem similar to that by which the partridge misleads the dog: she springs up, and flutters from spot to spot, by which means she allures her enemy to a safe distance. In France the hedge-sparrow is rarely seen but in winter; it arrives generally in October, and departs in the spring for more northern regions, where it breeds. It is supposed to brave the rigours of winter in Sweden, and that it assumes the white plumage common in these severe climates in that season. Its song is little varied, but pleasant, especially in a season when all other warblers are silent: its usual strain is a sort of quivering, frequently repeating something like the following *tit-tit tititit*; from which, in some places, it is called the titling.

We may here notice the wagtails and pipits.

Linnaeus comprised, under the denomination of *Motacilla*, a great number of birds with slender beaks, which have subsequently been divided into many genera. Bechstein has restrained the name to the wagtails proper, and budytes, which have more elevated limbs, and a longer tail than the rest, which they are continually lowering and raising. To such the name is more suitable than to any of the others. These birds have, moreover, as distinctive marks, certain scapular feathers, which, extending to the end of the wing, give them some relation with the majority of the grallae, and a tail composed of twelve rectrices nearly equal, with the two lateral however shorter than the eight intermediate quills. M. Cuvier has separated the wagtails proper from the budytes, a name derived from these latter birds being

frequently seen amongst cattle. There is, however, very great analogy between the two sections. Perhaps our popular name of wagtail is the best to apply to both. The majority of the wagtails proper, and all the yellow wagtails, migrate from our northern countries at the approach of winter. The *Boarula*, on the contrary, comes to pass the winter with us, and quits us when the others return. It is said to nestle in the German districts, which border on the French territories.

All these birds frequent meadows, and humid and marshy places, delighting in the borders of rivulets and rivers. Most of them have an undulating flight. They all run rather than walk; seldom perch, sing, or cry, during their flight; and construct their nest on the ground. That of the white wagtail is, however, sometimes found in a pile of wood, alongside of the banks, or in the hole of some wall whose base is washed by waters. Insects and small worms are their only aliment. They form, in autumn, numerous flocks, which extend themselves through the fields, and withdraw, on the approach of evening, into osieries and willows which border canals and rivers, there they perform a noisy concert until night-fall. They depart in October, and often at this period they are heard passing in the air, sometimes at a very considerable height, and clamouring to each other incessantly. They do not, however, all migrate at this season, for some, though a very few, are occasionally to be met with. They then abound in Egypt, where the people, says Maillet, dry them in the sun, to preserve them for the purpose of food. They are also to be seen in Senegal at the same season; but, like the swallows and quails, they disappear from thence in spring to return to our climates, where they arrive at the end of March. These birds possess the most astonishing gaiety and lightness. They appear in flying to rest upon their long outspread tail, as upon a broad oar, which assists them to balance, spring, and perform a variety of evolutions in the air. During such sports, they are frequently heard to utter a little cry, lively, clear, and redoubled, which sounds like the syllables *quit, quit, quit, quit, quit*. They have also a soft and delicate song, which in autumn is reduced nearly to a murmur. The motion of their tail in flying is horizontal, but on the ground its position is perpendicular. As they delight in being upon the edge of the water, and often approach the washerwomen that are there, and seem to imitate with their tails the beating of the linen, the French have given them the name of *lavedières*. They run lightly, with very nimble steps, upon the strand, and their long legs enable them even at times to enter the water to a small depth; but they are usually seen placed upon the stones and other little elevations about it.

The wagtail fixes its nest on the ground, under some roots, or below the turf; more frequently at the edge of waters, under some hollow bank, in elevated piles of wood alongside of rivers, and sometimes in heaps of stones. It is composed of dried herbs, small roots, and moss, connected carelessly together, and it is furnished inside with horse-hair, and feathers in abundance. The eggs are from four to six in number, of a bluish white, spotted with brown. There are usually two broods in the year. The male relieves the female during some hours in the day from the labours of incubation. The little ones are born covered with down. The father and mother defend them with much courage when they are approached. They meet the enemy, fly about to lead him to a distance, and often succeed in deceiving him by their manœuvres. If their young family is carried off, they fly about the head of the ravisher, turn incessantly, and continually utter piercing cries. It has been remarked that they attend very scrupulously to their young, keeping the nest extremely

neat, and cleansing it carefully from all kinds of filth and ordure. They ding these out, and even carry them to a certain distance. This last precaution seems to be the result of a different instinct from that of mere cleanliness. It would seem to be done rather with the view of removing every indication of the proximity of their nest. Many other birds use a similar precaution, especially during the first ten or twelve days after the birth of their young. They even carry off the egg-shells when the young are evolved, and take them to a considerable distance. This habit is so innate in birds, that even canaries, which, in a long lapse of captivity, one would imagine, would leave it off, take the shell, the moment the little one comes out, and either transport it to the dung which is in that part of their cage the farthest from the nest, and conceal it there, or else break it to pieces and swallow it. When the young family is in a state to fly, the parents still conduct and feed it, for three weeks or a month. This is a period in which they wage incessant war with the insect tribe, seizing and devouring them with the most extraordinary quickness, without appearing even to give themselves time to swallow them. They collect the little worms on the ground, gorge themselves with the eggs of ants, and often make turns in the air, to catch the flies and gnats. The wagtails are not distrustful, and are less fearful of man than of birds of prey. They are not even much frightened by fire-arms, for, on being aimed at, they do not fly far, and frequently return and place themselves within a short distance of the fowler. They go into all kinds of snares which are laid for them, quite easily; but if taken when adult, they cannot be preserved in cages, but will die in four-and-twenty hours. For this purpose, they must be taken from the nest, and reared like the nightingales. Of the species which frequent Britain are the Pied wagtail, the Gray or Water wagtail, and the Yellow wagtail.

The *Gray wagtail* (*Motacilla Boarula*), writes Mr. Bellamy, of Yealmpton in South Devon, "visits us without deviation yearly in the month of September, and remains until the end of March or the first of April, frequenting rivers, brooks, spring-heads, and the sea-coast. Some circumstance determines a slight irregularity of a few days, both in their arrival and departure,—most probably it is their food; but in respect of number there is apparently little difference. They seem to come in a body, and attract immediate attention by their tameness, and the briskness of their motions. Their retreat, however, is accomplished in a straggling manner; suddenly we lose the bulk of the party, and hear only the twit of a solitary bird or so, on the bank of a river, or at a spring-head; in a few days these are gone, and we see no more of them for a season. But though I am not able to bear testimony to the fact, this species has been known to remain all summer and breed. In 1831 I saw one frequenting a pond near Tavistock on the second of September. This may have been an unusually early arrival, or one of a pair that had stayed through the season. Their chief resorts are rivers and streams, but some repair to the sea-coast, and fare with the pied wagtail. In hard weather they seem all to frequent the roads, and seek support from the droppings of cattle, frost seeming to cause a general retirement of the insects on which they feed, or sealing down the soil and stones beneath which they harbour. I believe that if any precise dates for their arrival and departure could be ventured on, they would be September 15th and April 8th; yet in 1835 I saw a flock arrive at a small village on the sea-coast on August 13th. In their retreat also, in the spring preceding, I observed an unusual tardiness, and they disappeared gradually. No phenomena that we know of can enlighten us respecting these irregularities, any more than con-

cerning the cause of their migrations: we see that the pied wagtail haunts the same situations, feeds similarly, and is content to remain with us the year through; but some impulse carries the gray hundreds of miles northward to rear its young. It is now clearly made out that in the spring our flocks retire to the northern counties, it being there a stationary bird also; but, independently of Selby's authority for this, a paper which I possess, written by a naturalist living at Kendal, tallies so well in its account of the transits of this bird there with its movements in this county, as to have led me to suspect the nature of their retreat before I read Selby's statement. This gentleman, Mr. Gough, thus writes:—'The gray wagtail is a partial migrator; a few remain about the town through the winter, and these are joined by great numbers from the south in March, when they all retire to the rugged banks of the river Mutt to spend the season of incubation.' A remarkable feature in the habits and economy of birds is their adaptation of appetite to a variety of food, both as regards one season or time, and as regards various seasons, in which we frequently notice a change in their food. But few of the class confine themselves to one particular species of food, whereas a very large proportion partake of a variety, but still not similar in character. Thus, the gray wagtail searches out various insects, and is content to feed on such as are found on the shore, which necessarily must differ widely from those inhabiting the sides of rivers, or the streamlets. Very many birds, again, have appetites still more accommodating, and will devour food quite incongruous. This portion of the economy of the gray wagtail permits the extension of the species much more than would otherwise be effected, and we see also that it even protects the species to a great extent from death, for if it could not on emergency betake itself to the food afforded by the roads, when frost deprives it of more genial supplies, it must necessarily be the victim of want. We conclude also, that it is this principle of accommodation in the appetites and digestive powers of birds, and other creatures, which fits and enables them to live in the midst of alterations in their ordinary provender, effected by the operations of man, and which permits us to avail ourselves of their services in a domesticated or reclaimed state, without much trouble or inconvenience, their appetites shortly becoming adapted to an unaccustomed diet. And so, in their habits and actions, we must not fail to note a principle of accommodation of the same description. A little reflection must bring to our minds a thousand alterations in the face of Nature, wherever man has fixed his abode, or extended his domains; and as, on the one hand, we might *a priori* imagine the actions and habits of animals to be as undeviating and determinate on all points, as are the fundamental laws of their organizations and constitutions, so, on the other, we find a corresponding alteration and conformity of action in them, to suit our intrusions on their territories, our planting, our tillage, our building, and all our various operations on and prevariations of Nature. In civilized and cultivated territories scarce an animal moves but it encounters alterations of our making; and, though the lower tribes can experience but slight impediments, and can have to adapt themselves thereto only in a very minor degree, yet the higher tribes must certainly employ some portion of thought at times to overcome these hinderances; and, as before said, if instinct were so confined and constrained a power, as usually conceived, these alterations in Nature would infallibly disarrange all their proceedings. Judging by the analogy of a vast number of instances of departure from accustomed actions, and by the anomalies of individual cases, as contrasted with the proceedings of species taken in the aggregate, we conclude that

the instances of the gray wagtail's breeding in Devon are determined purely by choice, and are not dependent on any human causes or interferences, and that these are also cases showing that instinct is not so very constrained a faculty, but involves a certain portion of thought and volition. If the instincts implanted in the gray wagtail were of a definite, precise, constrained, and unalterable nature, they would necessarily pervade every member of the species; and so far from any pair of birds choosing to stay the summer with us, while all their fellows were preparing to migrate, no inducements of food ever so great, nor even any accidents or ailments impairing their bodily power, would prevent their essaying a flight ever so short and feeble; in fact, they would be compelled to exert themselves to the very utmost, and to sacrifice every feeling to this one object."

The *Yellow wagtail* (*Motacilla flava* of Ray and other English writers), Mr. Bellamy continues, "offers an illustration of the same diversity of operations among individuals of one species. This summer wagtail arrives here about the very time the gray wagtail leaves us, and it also quits us about the period the winter species comes. Still stragglers are seen on to November, according to some remarks I made in 1831, frequenting both the coast and inland stations; and in October 1833, and other years, they have been noticed haunting the beaches near Plymouth, so that, without contending for their stay through the whole winter, I have reason to infer that, like the gray sort, they are occasionally induced to act differently from the aggregate of their kind. Facts of the same nature as those I have above recorded, relative to these two birds, are also named by Mr. Markwich in 'Linnæan Transactions,' I. 126. The yellow wagtails congregate in August and September, and abide for several days on the beaches and shores, feeding among the sea-weed. They likewise affect open fields. The number collected at these times is disproportioned to our summer stock, so that probably this species approaches the southern parts of the kingdom previously to departure."

The *Pied wagtail* (*Motacilla alba* of most English writers) appears to be a bird of more enduring constitution than the other kinds, because it suffers the alternations of our seasons without removing to other situations. "It is resident with us," says Mr. Bellamy, "all the year. Its actions, however, clearly indicate the possession of powers of accommodating itself to circumstances of necessity; not that the species acts in concert, or that the movements and operations of the individuals are simultaneous and uniformly similar; on the contrary, each bird seems intent on its own peculiar interests, and its having been ordained that the appetites of this species of bird should not be restricted or very limited in capacity, some individuals are found to diet on the seashore, whereby greater space is allowed to other individuals to procure food. In summer, however, when the supply of food is so ample for the generality of creatures, the number of wagtails haunting the beaches is very small, whereas toward winter they augment greatly. Although I have said that the individuals appear to have separate and exclusive interests, yet it appears that some portion of the kind coaggregate and depart, we know not whither, some thinking they remove to other countries, and some contending that they merely take up fresh quarters in this same kingdom. However, this removal in August must act beneficially towards the remainder, both of that species and also towards the gray sort. During summer they may be found distributed by the sides of rivers and ponds, on roads and in gardens, besides being also on the shores and inlets, as before said. In June I have seen them both in that situation, and in my own garden, and

before the house on the road, searching for insects. About September, they are more particularly noticed arriving in the vicinity of houses and stable-yards. From that time, on through the winter, they obtrude themselves greatly in gardens, where they pick up the insects disturbed by the spade of the gardener, which had secreted themselves, and been wrapt in their winter's sleep, or in temporary torpor."

The *Pipits* or *Field-larks*, have much analogy with those of the larks proper, though they differ in certain details of conformation. Like the larks they sing in flying, and elevate themselves to a certain height in the air. They seek their nutriment, nestle, and sleep on the ground. Some frequent cultivated fields and meadows; others delight, during the summer season, in the borders of woods, in glades, in furze, in brushwood, thinly scattered; many prefer mountains, steep shores, rocks, and maritime pastures. Some few, in fine, inhabit, during summer, the little hills, in sandy and stony situations, and during the after season, sojourn on the banks of rivers, and seek their food upon the strand. A very small number have the power of perching constantly upon trees. There is considerable trouble in distinguishing them specifically. Of those common to Britain are the *Rock* or *Shore pipit*, the *Meadow pipit* or *tit*, and the *Tree pipit*.

CHAP. IV.

OF THE CANARY-BIRD, AND OTHER HARD-BILLED SINGING BIRDS.

THE Canary-bird is now become so common, and has continued so long in a domestic state, that its native habits, as well as its native country, seem almost forgotten. Though by the name it appears that these birds came originally from the Canary islands, yet we have it originally from Germany, where they are bred up in great numbers, and sold into different parts of Europe. At what period they were brought into Europe is not well known; but it is certain that about a century ago they were sold at very high prices, and kept only for the amusement of the great. They have since been multiplied in great abundance; and their price is diminished in proportion to their plenty.

In its native islands, a region equally noted for the beauty of its landscapes and the harmony of its groves, the canary-bird is of a dusky gray colour, and so different from those usually seen in Europe, that some have even doubted whether it be of the same species. With us they have that variety of colouring usual in all domestic fowls; some white, some mottled, some beautifully shaded with green; but they are more esteemed for their note than their beauty, having a high piercing pipe, as indeed all those of the finch tribe have, continuing for some time in one breath without intermission, then raising it higher and higher by degrees, with great variety.

It is this that has rendered the canary-bird, next to the nightingale, the most celebrated songster; and as it is more easily reared than any of the soft-billed birds, and continues its

sing throughout the year, it is rather the most common in our houses.¹ Rules, therefore, have been laid down, and copious instructions given, for breeding these birds in a domestic state;

¹ The canary is remarkable for its tractability and intelligence, as an instance of which the following anecdote may be given. A bird-catcher in Prussia, who had rendered himself famous for educating and calling forth the talents of the feathered tribe, had a canary-bird, which was introduced by the owner to a large party at Cleves, to amuse them with his wonderful feats. The canary being produced, the owner harangued him in the following manner, placing him upon his forefinger: "Bijou, (jewel,) you are now in the presence of persons of great sagacity and honour; take heed, therefore, that you do not deceive the expectations they have conceived of you from the world's report. You have got laurels; beware of their withering: in a word, deport yourself like the bijou (jewel) of canary-birds, as you certainly are." All this time the bird seemed to listen; and, indeed, placed himself in the true attitude of attention. He sloped his head to the ear of the man, then distinctly nodded twice, when his master had left off speaking; and if ever nods were intelligible and promissory, these were of that nature. "That's good," said the master, pulling off his hat to the bird. "Now let us see if you are a canary of honour. Give us a tune." The canary sung. "Pshaw! that's too harsh: 'tis the note of a raven with a hoarseness upon him: something pathetic." The canary whistled as if his throat was changed to a lute. "Faster," says the man: "slower—very well—what a plague is this little foot about, and this little head? No wonder you are out, Mr. Bijou, when you forget your time. That's a jewel: bravo! bravo! my little man!" All that he was ordered, or reminded of, did he to admiration. His head and foot beat time; humoured the variations both of tone and movement; and the sound was a just echo to the sense, according to the strictest laws of poetical, and (as it ought to be) of musical composition. "Bravo! bravo!" re-echoed from all parts of the room. The musicians declared the canary was a greater master of music than any of their band. "And do you not show your sense of this civility, sir?" cried the bird-catcher with an angry air. The canary bowed most respectfully, to the great delight of the company. His next achievement was going through the martial exercises with a straw gun; after which, "My poor Bijou," said the owner, "thou hast had hard work, and must be a little weary: a few performances more, and thou shalt repose. Show the ladies to make a courtesy." The bird here crossed his taper legs, and sunk and rose with an ease and grace that would have put half our subscription assembly *belles* to the blush. "That's my fine bird! And now a bow, head and foot corresponding." Here the striplings for ten miles round London might have blushed also. "Let us finish with a hornpipe, my brave little fellow: that's it; keep it up, keep it up." The activity, glee, spirit, and accuracy with which this last order was obeyed, wound up the applause (in which all the musicians joined, as well with their instruments as their clappings) to the highest pitch of admiration. Bijou himself seemed to feel the sacred thirst of fame, and shook his little plumes, and carolled an *Io pœan*, that sounded like the conscious notes of victory. "Thou hast done all my biddings bravely," said the master, caressing his feathered servant; "now then take a nap, while I take thy place." Hereupon the canary went into a counterfeit slumber, so like the effect of the popped god, first shutting one eye, then the other, then nodding, then dropping so much on one side, that the hands of

which, as a part of them may conduce towards the natural history of the bird, I will take leave to transcribe.

In choosing the canary-bird, those are best that appear with life and boldness, standing upright upon the perch like a sparrow-hawk, and not apt to be frightened at everything that stirs. If its eyes look cheerful, and not drowsy, it is a sign of health; but, on the contrary, if it hides its head under the wing, and gathers its body up, these are symptoms of its being out of order. In choosing them, the melody of the song should also be minded; some will open with the notes of the nightingale, and, running through a variety of modulations, end like the tit-lark. Others will begin like the sky-lark, and, by a soft melodious turn, fall into the notes of the nightingale. These are lessons taught this bird in its domestic state, and generally taught it by others; but its native note is loud, shrill, piercing, and enough to deafen the hearers. There are persons who admire each of these songs, but the second is in the most general estimation.

Canary-birds sometimes breed all the year round; but they most usually begin to pair in April, and to breed in June and August. Those are said to be the best breeders that are produced between the English and the French.

Towards the latter end of March, a cock and a hen should be put together in a small cage, where they will peck at each other in the beginning, but will soon become thoroughly reconciled.

several of the company were stretched out to save him from falling; and just as their hands approached his feathers, suddenly recovering, and dropping as much on the other. At length sleep seemed to fix him in a steady posture; whereupon the owner took him from his finger, and laid him flat on the table, where the man assured us he would remain in a good sound sleep, while he himself had the honour to fill up the interval. Accordingly, after drinking a glass of wine, (in the progress of which he was interrupted by the canary-bird springing suddenly up, to assert his right to a share, really putting his little bill into the glass, and then laying himself down to sleep again,) the owner called him a saucy fellow, and began to show off his own independent powers of entertaining, when a huge black cat, who had long been on the watch, sprung unobserved, from a corner, upon the table, seized the poor canary in its mouth, and rushed out of the window in spite of opposition. And though the room was deserted in an instant, it was a vain pursuit; the life of the poor bird was gone; and its mangled body was brought in by the unfortunate owner, under such dismay, and accompanied by such looks and language, as would have awakened pity in a misanthrope.

A talking canary was exhibited in London in 1839. According to the journals of the day this bird "articulates with singular neatness and fluency, and with as much ease and volubility as he warbles, though his vocabulary, of course, is very limited. In the middle of a snatch of a song, you hear him pronounce these words: 'Sweet pretty little Dicky,'—'Pretty Queen,'—'Dicky dear,'—and other fond appellations bestowed upon him by his mistress; he also makes a chirping imitation of a bell ringing, and calls 'Mary.'"—Ed.

The room where they are kept to breed should be so situated as to let the birds have the benefit of the morning sun, and the windows should be of wire, not glass, that they may enjoy the benefit of the air. The floor of the room should be kept clean, and sometimes there should be dry gravel or sand sifted upon it. There should also be two windows, one at each end, and several perches at proper distances for the birds to settle on, as they fly backwards and forwards. A tree in the middle of the room would be most convenient to divert the birds, and sometimes to serve for building their nests upon.

In Germany they prepare a large room, and build it in the manner of a barn, being much longer than broad, with a square place at each end, and several holes to go into those square places. In those outlets they plant several sorts of trees, in which the birds take great delight to sing and breed. The bottom of the place they strew with sand, and upon it cast rape-seed, chick-weed, and groundsel, which the old birds feed upon while breeding. In the body of the house they put all sorts of stuff for building the nest, and brooms, one under the other, in all the corners, for the birds to build in. These they separate by partitions from each other, to prevent those above flying down upon, or otherwise incommoding, such as breed below. The light also is excluded, for no bird is fond of having light come to its nest.

With us the apparatus for breeding is less expensive; a little breeding-cage sometimes suffices, but seldom anything more extensive than a small room. While the birds are pairing, it is usual to feed them with soft meat; that is, bread, maw-seed, a little scalded rape-seed, and near a third part of an egg. The room should be furnished with stuff for making their nests; such as fine hay, wool, cotton, and hair. These materials should be thoroughly dry, and then mixed and tied together in such a manner that the birds may readily pull out what they want. This should be hung in a proper part of the room, and the male will take his turn in building the nest, sitting upon the eggs, and feeding the young. They are generally two or three days in building their nests; the hen commonly lays five eggs; and in the space of fourteen days the young will be excluded. So prolific are these birds sometimes, that the female will be ready to hatch a second brood before the first are able to quit the nest. On these occasions she leaves the nest and the young, to provide herself another to lay her new brood in. In the meantime the male, more faithful to the duties of his trust, breeds up the young left behind, and fits them for a state of independence.

When the young ones are excluded, the old ones should be supplied with a sufficiency of soft food every day, likewise with fresh greens, such as cabbage, lettuce, and chick-weed; in June, shepherd's purse; and in July and August, plan-

tain. They are never to have groundsel after the young are excluded. With these different delicacies the old ones will take particular care to feed and bring up their young; but it is usual when they can feed themselves, to be taken from the nest and put into cages. Their meat then is the yolk of an egg boiled hard, with an equal quantity of fine bread, and a little scalded rape-seed: this must be bruised till it becomes fine, and then it may be mixed with a little-maw-seed; after which blend all together; which is to be supplied them fresh every day.

The canary-bird, by being kept in company with the linnet or the goldfinch, pairs and produces a mixed breed, more like the canary-bird, and resembling it chiefly in its song. Indeed, all this tribe with strong bills and piercing notes, and feeding upon grain, have the most strong similitude to each other, and may justly be supposed, as Mr. Buffon imagines, to come from the same original. They all breed about the same time; they frequent the same vegetables; they build in the same hedges and trees; and are brought up for the cage with the same food and precautions. The linnet, the bullfinch, and the goldfinch, when we know the history of the canary-bird, have scarcely any peculiarities that can attract our curiosity or require our care. The only art necessary with all those that have no very fine note, is to breed them up under some more pleasing harmonist. The goldfinch learns a fine song from the nightingale; and the linnet and bullfinch may be taught, forgetting the wild notes of nature, to whistle a long and regular tune.

SUPPLEMENTARY NOTE.

The finches are a numerous and active race, widely dispersed over the world, feeding principally on grain, seeds, and insects. Some of them are remarkable for the melody and variety of their notes, while others are destitute of song, and only utter a chirp.

The *Field sparrow* (*F. pusilla*) is a native of Pennsylvania; it is a migratory species, arriving in that State early in April. It has no song, but a note not unlike the chirp of a cricket. It is the smallest of the American finches.

The *Swamp sparrow* (*F. palustris*) is another summer visitant of Pennsylvania, where it arrives early in April, and frequents the low pine swamps. It rears from two to three broods in a season, returning to the south on the approach of cold weather. It has no song, but a simple *cheep*.

The *Tree sparrow* (*F. arborea*) is a native of the northern parts of America, taking up its winter residence in Pennsylvania, and most of the northern states, where it arrives in the beginning of November, and departs in April. It frequents sheltered hollows, thickets, and hedge-rows. It has a low warbling note.

The *Song-sparrow* (*F. melodia*) is very generally diffused over the United States, and is only partially migratory. It commences its song early in the spring, and continues its sweet warblings during the whole summer, and is sometimes even heard in the depth of winter. It frequents the borders of rivers, meadows, and swamps. Its nest is built on the ground.

The *Chipping sparrow* (*P. socialis*) is a social American species, inhabiting the city in common with man in the summer season; but retires to the fields and hedges as the cold approaches, and takes its final departure for the south of America when the frost sets in.

The *Goldfinch* is one of the best known, and most beautiful of our native birds. From the earliest days of spring, the enchanting voice of the male begins to be heard; but it is in the month of May that it puts forth its sweetest strains. Perched on a tree of moderate height, particularly on a fruit-tree, of which these birds are very fond, it makes the orchard echo with its song, from the point of day to the setting of the sun. It continues thus until the month of August, with the interruption, however, occasioned by the care of its young: for such is its attachment, that at this period all its moments are absorbed by its paternal duties. It feeds the young with tender seeds, such as those of groundsel, lettuce, and other plants. It is said, that it also gives them caterpillars, small scarabæi, and other insects; but it appears more probable that the goldfinches are simply granivorous, like the linnet, the canary, &c. It is on this account that they nestle later than the sparrows, the buntings, and the chaffinches, which rear their young on insects, and do not disgorge the food for them. The goldfinch, when its young are more advanced in age, gives to them grains more difficult of digestion, but never without softening them in its crop, and disgorging them like the canaries. It is so much attached to its progeny, that if shut up with them in a cage, it will continue to take care of them at the very epoch when liberty is so dear to other birds, that few of them survive its loss. But to manage this properly with the goldfinch, it must receive abundance of groundsel, &c., and particularly the seed of the thistle, which is its favourite food, and from which its French name (*Chardonneret*) is derived. It is also sometimes called, in our language, the *Thistle-finch*. The fowlers, accordingly, who lay various snares for these birds, make use of thistle-seed as their bait.

Though the goldfinches do not construct their nests until the middle of spring, they have yet three broods, the last of which takes place in August. The young cannot suffice for themselves for some time, even after quitting the nest; accordingly there is much patience requisite to rear them artificially. The best are said to be those which are born in thorny bushes, and belong to the last brood. They are, it is said, more gay, and sing better than the others. The goldfinch is very easily reconciled to captivity, and even becomes quite familiar. From its activity and docility it may be taught a wonderful degree of precision in its movements; it will counterfeit death, and perform a great variety of other movements with the greatest dexterity; it can be taught to fire a cracker, and draw up small cups, containing its food and drink. Some years ago, the *Sieur Roman* exhibited in this country the wonderful performances of his birds. These were goldfinches, linnets, and canary birds. One appeared dead, and was held up by the tail, or claw, without exhibiting any signs of life. A second stood on its head, with its claws in the air. A third imitated a Dutch milkmaid going to market, with pails on its shoulders. A fourth mimicked a Venetian girl, looking out at a window. A fifth appeared as a soldier, and mounted guard as a sentinel. The sixth was a cannonier, with a cap on its head, a firelock on its shoulder, and a match in its claw, and discharged a small cannon. The same bird also acted as if it had been wounded; it was wheeled in a little barrow, to convey it (as it were) to the hospital, after which it flew away, before the company. The seventh turned a kind of wind-mill; and the last bird stood in the midst of some fire-

works, which were discharged all round it, and this without exhibiting the least sign of fear.

The goldfinch, naturally active and laborious, is fond of occupation in its prison, and if it has not some poppy-heads, hemp-stalks, and those of lettuce, to peck, for the purpose of keeping it in action, it will remove every thing that it finds. A single goldfinch in an aviary where canaries are hatching, if he be without a female, is sufficient to make all the broods fail; he will fight with the males, disturb the females, destroy the nests, and break the eggs. These birds, however, though so lively and petulant, live in peace with each other, excepting a few quarrels about the perch and their food; all of them try to get possession of the highest perch in the aviary, for the purpose of sleeping, and the first who obtains it will not suffer the others to approach. It is necessary to place all the perches at a similar height, to isolate each from the other, and make every one only of length sufficient for a single bird.

The mules from the goldfinch and canary are more robust than the latter, and live longer. Their song is also more brilliant; but Buffon says, that they imitate airs with difficulty. Others, on the contrary, pretend that they can very easily be taught by the bird-organ and flageolet. These mules resemble the male in the form of the bill, and the colours of the head and wings, and the female in the rest of the body. Some beautiful varieties result from this alliance. M. Vieillot once caught a mule, which he conceived was the produce of a male greenfinch and female goldfinch, judging from its size, colours, and song. This bird did not appear to be the result of any forced union; it always remained extremely wild, and by no means familiarized with the cage—a seeming confirmation of the last remark. It was brought, notwithstanding, to couple with a female canary; but nothing resulted from the union. Some, however, say that these females are not unproductive, and that the second generation insensibly approaches the characters of the male; but this second generation must be marvellously rare, for no authentic proof appears of its having ever been witnessed. These mules, however, pair very readily with each other, or with canaries; but the eggs produced are not fecundated. The female mules construct their nests much better than the canaries; and are such excellent nurses that they may be frequently substituted for the others, when the latter are sick, or are bad mothers.

In autumn the goldfinches assemble together, live, during winter, in numerous flocks, and frequent those places where thistles and wild endive grow. During the severe cold, they shelter themselves in thick bushes; but they seldom recede far from the place where their food is found. Sometimes they mingle with other granivorous birds. Hempseed is the grain given to familiarize them with the cage; but it would be better to mingle millet and rape seed with it, and to vary their aliment; thus the maladies might be avoided which attack them in captivity. This is a point not always properly attended to, for cage birds of all descriptions. Variation of food preserves them in good health, lengthens their days, and approximates them to their natural state.

The species of the goldfinch is extended throughout the whole of Europe nearly, and through some parts of Asia and Africa. It is found in Greece, where it bears the name of *karedreno*; though no migrating bird, properly speaking, it does not remain all the year round on all the islands of the Archipelago. It prefers the largest, and also the lands of the neighbouring continent, because it doubtless finds there more safe and agreeable retreats.

Few species present more varieties than this; besides those which proceed from forced alliances, there are others attributable to aliment, to age, and

to domestication. There is one which is white where the others are red, namely, on the forehead and eyebrows, which colour also prevails on the top of the head, instead of black. On some the red is shaded with yellow, and the black appears through these colours. A goldfinch, with the head striped with red and yellow, has been found in America. One with the cap altogether black has but a few red spots on the forehead; the back and chest are of a yellowish brown; the iris yellowish, and the bill and feet flesh-colour. The whitish goldfinch has the tail and wings of an ashen brown, the upper and under parts of the body whitish, and the yellow of the wings pale. Some varieties are totally white, and others, among which are the handsomest races, have the head red and the wings bordered with yellow. On the bodies of many the tints are more or less mingled with white. Among the black goldfinches some are entirely black; others more or less varied with this colour. These last varieties are chiefly attributable to food, especially to the exclusive use of hempseed. Still the colours are not fixed, for goldfinches have been known to resume their primitive tints after moulting; and some which were even totally black to retain very fine feathers of that hue. These changes from one moulting to another become still more palpable when millet or other grain is substituted for hempseed.

Several naturalists have made two species of the *linnet*, properly so called, under the denominations of *gray* and *red*; others have no doubt of the identity of the red and gray linnet: and this opinion is confirmed by repeatedly multiplied and indefatigable observations. Both kinds, young and old, male and female, are gray in the back season, and resemble each other so much, that the sexes cannot be distinguished, except by the white border on the primary alar quills, which is more broad and brilliant in the male than in the female. The red colour which characterizes the male during summer, commences to appear towards the end of autumn; but at this time it is tarnished, and occupies only the middle portion of the feathers, the extremity of which is of a reddish gray, so that it can only be perceived by raising them up. In proportion as the spring approaches, this colour extends and grows brighter, and towards the month of May becomes very brilliant in the male of two years old; less pure and less extended in the bird of the first year; and among the old ones it sometimes assumes an orange shade. Of course, the linnets which remain gray must be only females; and it does not appear that any well-authenticated instance of a male of this hue at such periods has been found.

There is a great analogy between the linnet and the canary. Their habits and nature are extremely similar, and of all birds the linnet is that which most readily couples with the canary. Although the linnet is one of the commonest of our small granivorous birds, and though it preserves no brilliant colours in captivity to render its possession desirable, it is not less in request than the brilliant goldfinch and charming bullfinch. Its natural disposition is docile, and susceptible of attachment; its song is agreeable, and the flexibility of its throat enables it to imitate with facility the different airs it is attempted to be taught. It can even be taught to repeat many words distinctly, in different languages, and it pronounces them with an accent that would actually lead one to suppose that it understood their meaning. The tender attachment of which these birds are susceptible is astonishing; so much so, that they often become troublesome in their caresses. They can perfectly well distinguish the persons who take care of them. They will come and perch upon them, overwhelm them with caresses, and even seem to express their affection by their looks. They can

also imitate and unite to the varied modulations of their own voice, the strains of other birds, which they are in the habit of hearing. If a very young linnet be brought up with a chaffinch, a lark, or a nightingale, it will learn to sing like them. But it will in most cases totally lose its native song, and preserve nothing but its little cry of appeal. The linnets intended to be instructed in foreign strains, should be taken from the nest when the feathers begin to shoot. If taken adult, they will seldom profit by their lessons, though they will become both familiar and caressing. Different modes of instruction have been pointed out for them—such as whistling to them in the evening by candle light, taking care to articulate the notes distinctly. Sometimes, to put them in train, they are taken on the finger, a mirror is presented to them in which they think that they see another bird of their own species, which illusion is said to produce a sort of emulation, making them sing with more animation, and expediting their progress; but these precautions are not absolutely necessary, for the best instructed linnets are often brought up by cobblers, who whistle to them without interrupting their work. It has been remarked of the linnets, and it is true of many other singing birds, that they sing more in a small cage than a large one.

This bird lives a long time in captivity, if well taken care of. Somini quotes an instance of one that lived forty years, and might have lived longer had it not perished by accident. This was a bird of the most extraordinary amiableness and docility. It was in the habit of calling many persons of the house by their name, and very distinctly. It whistled five airs perfectly, from the bird-organ. The linnets have the advantage of singing all the year round, and they may be taught a variety of tricks, like the siskin, and the goldfinch. The nest of the linnet is generally built in furze, or some other low bush, and is formed of moss and stalks of grass interwoven with wool, and lined with hair and feathers. In winter linnets assemble in large flocks, and descend to the sea-coasts, where they continue to reside, till spring again urges them to pair and seek their upland haunts. They feed upon the seeds of flax, thistle, dandelions, &c.

The *siskins* are birds of passage, and fly so high that they may be heard before they are seen. They are very numerous in the southern provinces of Russia, and common enough in this country during the winter; they are fond of places where the alder-tree abounds. They arrive in France about the time of the vintage, then proceed farther south, and reappear when the trees are in flower; but in summer they are not seen. In all probability they then voyage northwards, or return into thick forests on the lofty mountains. But there is evidence that they occasionally breed in Scotland. Mr. Carfrae, preserver of animals, Edinburgh, says: "The siskin is a common bird in all the high parts of Aberdeenshire, which abound in fir woods. They build generally near the extremities of the branches of tall fir trees, or near the summit of the tree. Sometimes the nest is found in plantations of young fir wood. In one instance I met with a nest not three feet from the ground. I visited it every day until four or five eggs were deposited. During incubation the female showed no fear at my approach. On bringing my hand close to the nest, she showed some inclination to pugnacity, tried to frighten me away with her open bill, following my hand round and round when I attempted to touch her. At last she seized a firm hold of my finger, and held fast. I visited her almost every day, and could with perfect confidence stroke down her back. At last she would only look anxiously round to my finger, without making any attack on me. The nest was formed of small

twigs of birch or heath outside, and neatly lined with hair."

Mr. Weir of Boghead, a most zealous observer of the habits of birds, gives the following account of the breeding of the siskin in the neighbourhood of Bathgate, in the county of Linlithgow:—"About the end of May 1834, as I was returning from Bathgate, I was astonished at seeing, on the parish road between it and my house, a pair of siskins feeding very greedily on the ripe tops of the dandelion. The head of the male was very dark, and the yellow on its wings uncommonly rich. I followed them for several hundred yards, being exceedingly anxious to discover their nest. In this, however, I did not succeed, as they flew off to a considerable distance, when I lost sight of them. I again and again renewed my search, but without success. A few days after this, two persons who were catching linnets with bird-lime in a small field belonging to me, were struck with the unusual chirping of young birds in a spruce which was planted in the middle of a very strong hawthorn hedge. When they were looking into the tree, in order to discover what kind of birds they were, they immediately flew out of their nest. They appeared to have a resemblance to the female siskin; but as they were ripe, it was found impossible to secure any of them. The nest was small, built on two of the branches, one side of it resting upon the trunk of the tree, at the height of about five feet and a half from the ground, and within twelve yards of the North Glasgow road. It was one of the best concealed nests I recollect of ever having seen; indeed, had it not been so, it would not have so long eluded the notice of some of our most celebrated nest-hunting youths, who were almost in the daily habit of passing and re-passing the place in pursuit of their favourite amusement. The old siskins, with their young, were seen for two or three weeks afterwards in the immediate neighbourhood."

The siskins, in their habits, have very considerable relations with the linnet: they give a preference to the seeds of the alder-tree; they often dispute with the goldfinches for the seed of the thistle. Hempseed is for them an aliment of choice; but they appear, especially in captivity, to be greater consumers of it than they really are, from a habit which they have got of breaking more grains than they eat. In their passage in Germany, in October, they considerably damage the hop-grounds, by eating the seeds. In France, also, they do considerable prejudice to the apple-trees, by pecking at the flowers. The song of the siskin is by no means disagreeable, but very inferior to that of the goldfinch; it is said to possess the faculty of imitating the song of the canary, linnet, &c. if taken very young, and placed within hearing of these birds; it has, moreover, a note of appeal peculiar to itself. Even when taken adult, it is easily tamed, and becomes almost as mild as a canary.

The *Citrel-finch* is found in all Italy, Greece, Turkey, Austria, Provence, Languedoc, Spain, Portugal, and sometimes in Lorraine. The male has an agreeable and varied song, but not so fine and clear as that of the canary. In Italy this species makes its nest not only in the country, but oftentimes in gardens on tufted trees, particularly on the cypress, and constructs it of wool, horse hair, and feathers. The eggs are four or five: the male easily pairs with the female canary, and the mules have been found productive. The Count de Riocourt had for many years several of these mules, which coupled with female canaries, and the young produced new generations. The siskin, the goldfinch, and the linnet, are those respecting which the production of the female with the male canary is best authenticated. If mules are desired from these birds, they must be taken on the

nest brought up by hand with the canaries, fed on the same aliment, and kept in the same aviary. The goldfinch, for example, which is generally chosen in preference, should be kept from hempseed, and accustomed, as soon as he is able to eat alone, to millet and rape-seed, the ordinary food of the canaries. Without this, a risk is run of losing one or the other, in changing their diet. If hempseed be suddenly taken from a goldfinch accustomed to it, to give him the ordinary food of canaries, the change will make him ill, and may cause his death. If, on the contrary, you leave him the hempseed, the female canary will eat so much of it, that she will get a fever, and probably die. What is said of the goldfinch is applicable to all other birds destined for the same purpose. It is also recommended, in the case of the goldfinch, to cut the extremity of his bill dexterously, for about the thickness of a halfpenny, or not quite so much. If some drops of blood should follow, there is no occasion for apprehension. It may be stanchd with a little saliva, mixed with pulverized sugar. This operation, however, should only be performed on those goldfinches whose bill is very pointed, which often happens in captivity. This is absolutely necessary, because this bird, pursuing the female, may wound her with his sharp bill, and prick the little ones in disgorging to them their food, which will destroy them. This inconvenience never takes place with goldfinches at liberty, for their bills are never so pointed as the bills of the caged birds. If a female goldfinch is paired with a male canary, she should be two years old, for it is seldom that she lays in the first year. These birds, naturally wild, should be rendered as tame and familiar as the canaries, which may be accomplished by putting them in a low place, where there is plenty of company. It must not be imagined that all the mules which result from this alliance will be handsome. Of some, the plumage is of a very common kind, and the song very inferior. It would be useless to give any description of them, for they vary *ad infinitum*, and no description would suit any but the individual described. It is sufficient to say, that it is constantly observed that the mules resulting from these mixtures resemble the father in the head, tail, and limbs, and the mother in the rest of the body; and that the mules which come from the male linnet and female canary, have neither the white colour of the mother, nor the red of the father, as some have pretended.

The union of canaries with siskins, whether males or females, requires less attention. It is enough to let loose one or many of these birds, but always of the same sex, in a chamber, or large aviary, with canaries, and they will soon be seen to couple. We have said, of the same sex, because when the sexes are different the birds will naturally prefer their own species. The goldfinch, on the contrary, will only pair with the canary in a cage; to the linnet, greenfinch, and bullfinch, the cage and the aviary are indifferent. The commonest mules are produced from the linnet, the greenfinch, and the siskin, and the most esteemed of these, for song and beauty, are those from the male canary and a strange female. The mules from the greenfinch are in general of a bluish colour, and the males sing very badly, especially if the father be a greenfinch. The male mules from a linnet sing much better, but their plumage is very ordinary. Those of the siskin are small, and sing badly. Those from the bullfinch are susceptible of a perfect education, and their plumage is singular; but this alliance rarely thrives. The male feeds, it is true, like the canary, and pays much attention to the female. But she dislikes and flies from him. His cry, and the opening of his wide bill, frightens her. It is necessary to choose a vigorous female or male, which has been brought up with bullfinches, and has never coupled with a bird of its own species.

To have fine mules and good singers, they should be of the race of the goldfinch. This bird should be chosen robust, gay, ardent in singing, and of a fine plumage. A goldfinch even taken in the net will couple, but he must at least have passed a month with the canaries, and be accustomed to their food from the moment he is taken; for had he been previously fed on hempseed, and suddenly deprived of it, he would assuredly perish. After coupling, and when the young are produced, the goldfinch, whether cock or hen, should receive thistle-seed from time to time, for these birds are extremely fond of this seed, and it may be considered as their primitive and essential aliment in a wild state. Groundsel is also suitable to them, and may be substituted for the thistle-seed when the latter is not mature. If a linnet be chosen, it should be a male, for the experiment with a female is rarely successful. Chaffinches and buntings are extremely difficult to make unite with canaries. M. Vieillot says, that he knew but of one example of a female of these species having produced fruitful eggs with a male canary. From these facts it would appear that the siskin, male or female, will produce equally with the cock or hen canary; that the hen canary produces easily with the goldfinch, less easily with the linnet; that it can produce, but not easily, with the male chaffinch, bunting, greenfinch, and sparrow, and, very rarely, with the male bullfinch; but the male canary will not produce easily, except with the female siskin, hardly with the goldfinch, and not at all with the others. It appears also, from observation, that of all birds coupled with the canary, the serinfinch, or green canary, as it is sometimes called, has the strongest voice, and is most vigorous and ardent for propagation. It would also appear that it is the only one whose mules are fertile, which argues a close affinity, if not identity, of species. The siskin and the goldfinch are neither so vigorous nor so vigilant.

The mules sing longer than the canaries, are of a more robust temperament, and their voice is stronger and more sonorous. But they learn foreign strains with greater difficulty, and always whistle them imperfectly. All the young mules should be placed under old canaries, of a fine voice, and fond of singing, to instruct them, and serve as music masters. The same thing should be done with the young canaries.

It is pretended, that those bastard birds which come from the mixture of canaries with siskins, goldfinches, &c. are not sterile mules, but fertile mongrels, which can unite and produce not only with their paternal and maternal races, but also with each other, and give birth to fruitful individuals, the varieties of which may also mingle and be perpetuated. M. Vieillot tried experiments in this way, and used every possible means, for more than twenty years, without success. He also consulted in Paris a great number of amateurs, and of bird-dealers, who might be relied on, who sell every year a great number of mules from the goldfinch and hen canary, either born in Paris, or brought from Amiens, where the handsomest are bred; and all certified that these mules were unfruitful, and that they never knew an example of the contrary, in spite of the reiterated attempts which they had made every year, but to no purpose, to produce one. The male mule will, it is true, couple with the hen canary, and *vice versa*, and also bestow all the necessary attentions; but nothing but barren eggs is the consequence. The result is similar from the junction of the mules themselves, and it is the same with those which proceed from the linnet, the siskin, the greenfinch, and the bullfinch, and the same remark may be applied to birds of every other order, genus, and species. It is the same with the mules of the white or collared

turtle dove and the common species, with those of the cock pheasant and the common hen, the duck of India and our domestic breed.

The *chaffinch* bill is of a pale blue, tipped with black; eyes hazel; the forehead black; the crown of the head, and the hinder part and sides of the neck, are of a bluish ash-colour; sides of the head, throat, fore-part of the neck, and the breast, are of a vinaceous red; belly, thighs, and vent white, slightly tinged with red; the back is of a reddish brown, changing to green on the rump; both the greater and lesser wing-coverts, are tipped with white, forming two pretty large bars across the wing; the bastard wing and quill feathers are black, edged with yellow; the tail, which is a little forked, is black, the outermost feather edged with white; the legs are brown. The female wants the red upon the breast; her plumage in general is not so vivid, and inclines to green; in other respects it is not much unlike that of the male.

The *Mountain-finch* or *Brambling* is a native of northern climates, where it spreads into various parts of Europe: it arrives in this country in the latter end of summer, and is the most common in the mountainous parts of our island. Vast flocks of them sometimes come together; they fly very close, and on that account great numbers of them are frequently killed at one shot. The length of this bird is somewhat above six inches. Bill yellow at the tip; eyes hazel; the feathers on the head, neck, and back, are black, edged with rusty brown; sides of the neck, just above the wings, blue ash; rump white; the throat, fore-part of the neck, and breast, are of a pale orange; belly white; lesser wing-coverts black, tipped with pale yellow; quills dusky, with pale yellowish edges; the tail is forked, the outermost feathers edged with white, the rest black, with whitish edges, legs pale brown.

The *bullfinch* belongs to the family of Grosbeaks. The primary character of the grosbeaks is that from which they are named. Their beak, in general, is extremely solid and powerful, and, except in the group of bullfinches, is conical and pointed. The tongue is also strong, and has a longitudinal furrow; the head is larger, and more fleshy than in the insectivorous birds in general; the internal toe is free, but the three exterior are connected at their base. Notwithstanding these distinctive peculiarities, there exists considerable difficulty in separating this group of birds from many others; a difficulty, indeed, not peculiar to them, but prevalent in every branch of zoology, whenever the natural method is attempted to be made the sole basis of arrangement.

The numerous species of the grosbeaks differ among themselves widely in habits and locality. Particular species are confined to particular countries; but the genus is spread over almost all moderate climates. The majority of them live in pairs only, solitary and silent; but others associate in flocks, and have a pleasing song. Some resort to the interior of woods, while others are found in the open country, in coppices, or in low and marshy situations; these construct their nests on the branches of elevated trees, or in the midst of thick bushes, while those commit their young to the shelter of some hole. In the nature of their aliment they seem more consistent. This, as is sufficiently indicated by the character of the bill, is composed principally of kernels and hard grains, from their facility in breaking which the word *coccothraustes* has been applied by Brisson, generally, to them all, though Gesner first used it to distinguish the common species. The crossbills, which are found in the northern countries of Europe and America, resemble the grosbeaks, and are supposed by some naturalists to be a species of that genus.

The bullfinch is found in most parts of Europe frequenting woods and gardens. In a state of nature

the bullfinch has but three cries, all of which are unpleasant: but if man deigns to instruct it methodically, and accustom it to finer, mellower, and more lengthened strains, it will listen with attention; and the docile bird, whether male or female, without relinquishing its native airs, will imitate exactly, and sometimes even surpass its master. "I know a curious person," says the author of the *Ædonologie*, "who, having whistled some airs quite plain to a bullfinch, was greatly surprised to hear the bird add such graceful turns, that the master could scarcely recognise his own music, and acknowledged that the scholar excelled him." It must, however, be confessed, that, if the bullfinch be ill directed, it acquires harsh strains. A friend of the Comte de Buffon's, saw one that had never heard any person whistle but carvers; and it whistled like them, with the same strength and coarseness. The bullfinch also learns to articulate words and sentences; and utters them with so tender an accent, that we might almost suppose it felt their force. These birds are also susceptible of personal attachment, which is often strong and durable.—Some have been known, after escaping and living a whole year in the woods, to recognise the voice of their mistress, and return to forsake her no more. Others have died of melancholy, on being removed from the first object of their attachment. They will also remember injuries received. A bullfinch that had been thrown to the ground in its cage by some of the rabble, though it did not appear much affected at the time, fell into convulsions ever afterwards at the sight of any mean-looking person, and expired in one of these fits eight months after its first accident.

Although this note has already extended to an unusual length, we are obliged here to notice the *Widow-Birds*. Such is the appellation of a handsome family of birds, found not only in Africa, but also in Asia, as far as the Philippine Islands. This name, which seems to suit them well enough, whether by reason of the black which predominates in their plumage, or their long sweeping tail, has, however, been given them through mistake. The Portuguese gave them the name of *Whidha*, from a kingdom of Africa, where they are very common; and the resemblance of this word to that signifying widow in the Portuguese language, proved a source of deception to foreigners, more especially as the latter name agreed so well with many characters of the birds. The females are never adorned with the long tail, and the males have it only during six months, which are not the same for all. With the young it appears to depend on the day of their birth; with the adult, on the climate which they inhabit. The first moulting in which the males assume their bridal habits, and begin to sing, takes place in spring, and the second in autumn, or, to speak more correctly, at the epochs which correspond to those seasons in intertropical countries. After the last moulting, the males resemble the females so nearly, that they may be very easily confounded together, without that very accurate knowledge of them which can only be obtained by frequent and almost habitual comparison. The females also undergo two moultings, but suffer no changes except that in growing old; some are observed to assume colours almost similar to those of the male, during the season of reproduction.

The varied changes of plumage which take place during the year in this family of birds, is not less extraordinary than useful in pointing out to the ornithologist how careful he should be in not at all times depending on colour, or even the structure of the feathering, in descriptions of species. There is no doubt but in many instances these are good grounds of distinction, and when taken in conjunction with other specific marks, are generally of much

use in characterizing species. In almost the whole of the feathered creation, considerable change of plumage takes place, from the young to the adult state; and in many instances so great is this alteration, that even the best ornithologists in Europe have described immature birds, in their various progressive approaches towards their perfect state, as animals of a different species. This has been more especially the case with birds of the vulture, eagle, and falcon tribes, and many others of the larger birds, most of which take from three to five, and even six years of arriving at the adult state; while the smaller birds usually reach maturity in one or two years. But in the instance of the Whidah bunting, we have a bird exhibiting remarkable changes twice a-year.

The Whidah bunting is five inches and three quarters from the tip of the bill to the extremity of the tail; and, in this state, is not unlike the common bunting of Britain, the bill is, however, stronger, and of a pale-bluish lead colour; the irides dark hazel. When the first change of feathering has been effected, its general tone is a pale ash-colour, which gradually deepens till it becomes of a dark wood-brown, with black patches over different parts of the head, neck, and back; a black stripe reaches from the bill to the nape, on each side, immediately over the eyes, with a double longitudinal row of black spots on the crown of the head; the auricles are also black. The minorities of the wing with black patches at their base; the primaries, secondaries, middle wing coverts, and remiges, deep black, with cinereous edges; the middle and lateral tail feathers black, edged with pale wood-brown: from the pectus to the crissum the belly is pure white, deepening into wood-brown, towards the wings; thighs white; legs, feet, and claws, pale skin-colour, which they preserve during the whole year. A precise description of the plumage, in its winter or summer garb, will not apply, during either of the periods of these moults, for, as above noticed, it is perpetually changing, so that my descriptions apply only to its perfect condition. The summer attire, when perfect, has the head as low as the nape, chin, forepart of the throat and neck, wings, vent, and tail of a deep black; the lower part of the neck or jugulum, bright orpiment-orange; the breast or peltus vivid burnt terra-sienna, growing paler as it descends; the belly or epigastrium, and tibia, white in the centre, inclining to orange towards the wings; the two middle tail feathers are four inches in length, placed vertically, one inch and a fourth broad, ending in a filamentary prolongation of the quills, an inch and a half long, tipped with a small knob of feathers; the two outer tail feathers are nine inches and a half in length, and an inch and an eighth broad at their centre, gradually tapering towards each end, and terminating in a filament an inch and an eighth in length, with a knob at their tips. From the middle of the shafts of these last arise two long thread-like extremely flexible feathers, four and a half inches in length; the under tail feathers are four in number, two and a quarter inches long, black, with cinereous edges. The whole tail feathers are extremely glossy, and strongly undulated, which is distinctly to be seen, and is very perceptible to the touch: which last character is peculiar to all the feathers of the bird, but not so evident without the assistance of a lens. The bill undergoes considerable change in the summer and winter plumage, both in shape and colour, which is produced by exfoliation, being deep bluish-black in summer and pale lead colour in winter.

The female Whidah bunting, when young, has much the appearance of the male bird in its winter dress, but considerably deeper in the tone of its plumage, which annually becomes darker till it arrives at its mature age, which is said to be four years.

Like the male, it also undergoes considerable change in its summer and winter moults; in the latter state being of a dark rusty brown, with patches of black on the head, neck, and back; and, in its summer garb, is of deep blackish-brown, without any patches of black, but considerably lighter on the belly. It is always destitute of the long tail feathers, like the male.

This remarkable species is a native of Africa, and is said to be common at Mongolia, Angola, and the neighbourhood of Fort Whidah, in which last locality it abounds, and in consequence has derived its name. It has no song, but utters a sharp and clear chirp, not unlike that of the common bunting of Great Britain before rain. It is a lively and active bird, seldom resting above a few seconds in one place or position during the day.

The *Buntings* (*Emberiza*) are distinguished from other passerine birds, principally by their conical, short, and straight bill, and by the addition of a knob in the roof of the upper mandible, which is made use of by the bird as an anvil on which to break and comminute its food. This apparatus is sufficient to lead the observing naturalist *per saltem*, as it were, to the conclusion that this genus of birds must be granivorous. It is true, indeed, that very many birds are enabled to crack and open nuts and hard seeds, without the aid of that extra provision with which the buntings are furnished; and this is one of the countless instances which might be adduced to display the various means employed by Nature to attain one and the same end. How different, for instance, are the means by which the several classes of animals attain the common object of locomotion, and how various are the modifications of those means in the respective genera! The buntings, however, do not feed exclusively on vegetable matter; like most of their order, they subsist also partially on insects and worms.

The *Yellow bunting* (*E. Citrinella*), in our own country, is known to every one under the name of the yellow-hammer. The yellow on the crown of the head is sometimes replaced by olive-green: and this, as well as other occasional deviations from the ordinary gamboge yellow of this bird, would in all probability have induced the erroneous multiplication of species, had the yellow bunting and its incidents been less universally known. This bird builds in a careless manner, on the ground, or towards the bottom of a small bush. The exterior of the nest consists of straw, moss, dried leaves, and stalks; and within is a little wool. Notwithstanding the carelessness of its nidification, however, few birds display stronger attachment to the young and to their eggs, than this; so much so, as to be not unfrequently taken by the hand, on the nest, rather than abandon its offspring in time to save itself. The eggs are in general about five in number, and are whitish, with red streaks.

The *Foolish bunting* frequents the warmer situations of Europe, and lives solitary in mountainous districts. It is said to have gained deservedly its epithet, from the ease with which it falls into every kind of snare.

The *Girl bunting* may be considered a British species, as it is not uncommon in company with the yellow bunting and the chaffinch on the southern coast of Devonshire. A straggler has, indeed, been killed in Scotland.

The *Reed bunting* (*E. Schaniolus*) is about the size of the yellow bunting, and is common in this country. It constructs its nest in grass or furze, near the ground, and has been said to attach it to three or four reeds above the water, whence its name. The eggs are four or five in number, bluish white, spotted, and varied with brown. "I have now and then," says Dr. Latham, "seen this bird

in the hedges, or the high road; but the chief resort is near the water; and that it, among other things, feeds on the seeds of the reed, is clear, as I have found them in the stomach." Though not uncommon, they are not found in large flocks. Though this species is said to be the best songsters of the genus, its musical pretensions seem by no means to be boasted of. It is perennial in this country, though said to migrate in other parts of Europe.

The *Common bunting* (*E. Miliaria*). This species is rather larger than the yellow bunting, and is much less common here. While in France, they are merely occasional residents, and arrive there in the spring, from the south, shortly after the swallows, and quit that country again in the beginning of autumn; they are found here during the whole year, and congregate in winter in large flocks, when they are frequently caught in numbers, and sold under the name of bunting larks, ebbs, or corn bunting. They nestle on or near the ground, have four dirty-white eggs, spotted and streaked with brown; and the young have a reddish tinge. During incubation, the male is generally found perched on a branch not far distant from his mate, constantly uttering a tremulous kind of shriek, several times repeated, with short intervals. Their unavailing anxiety to protect their eggs and young, frequently leads to the spot where they are deposited, which the simple birds are so unwilling to forsake, and, in their anxiety, so easily betray.

The *Ortolan bunting* (*E. Hortulana*) is never known to visit this country. This bird, whose flesh is very highly esteemed, and which is consequently much sought after, appears to be confined to the southern parts of Europe, where it is found at all seasons. All the individuals of the species are not, however, confined to one locality the whole year; for a few of them quit the south in the spring, and visit for a time the intermediate latitudes of Europe. Even these, however, do not breed in all the countries they visit, as their nests are said to be found only in Germany, and Lorraine and Burgundy, in France. It is commonly near the stem of the vines that they build their ill-constructed nest, in which the female deposits four or five eggs. In Lorraine, they are said to build in the corn fields. When these birds first arrive in Italy and France, they are far from fat; but human ingenuity soon makes them fit for the table. It is the fat of the bird which is so delicious; but it has a peculiar habit of feeding which is opposed to its rapid fattening, this is, that it feeds only at the rising of the sun. Yet this peculiarity has not proved an insurmountable obstacle to the Italian gourmands. The ortolans are placed in a warm chamber, perfectly dark, with only one aperture in the wall. Their food is scattered over the floor of the chamber. At a certain hour in the morning the keeper of the birds places a lantern in the orifice of the wall; the dim light thrown by the lantern on the floor of the apartment induces the ortolans to believe that the sun is about to rise, and they greedily consume the food upon the floor. More food is now scattered over it, and the lantern is withdrawn. The ortolans, rather surprised at the shortness of the day, think it their duty to fall asleep, as night has spread his sable mantle around them. During sleep, little of the food being expended in the production of force, most of it goes to the formation of muscle and fat. After they have been allowed to repose for one or two hours, in order to complete the digestion of the food taken, their keeper again exhibits the lantern through the aperture. The rising sun a second time illuminates the apartment, and the birds, awaking from their slumber apply themselves voraciously to the food on the floor; after having discussed which they are again enveloped in darkness. Thus the sun is made to shed its rising

rays into the chamber four or five times every day, and as many nights follow its transitory beams. The ortolans thus treated become like little balls of fat in a few days. The process speaks much for the ingenuity of its inventor, if it does not for the intellect of the ortolan. In this refined mode of feeding every condition for the fattening of an animal is united, that is, warmth, plenty of food, and want of exercise.

Among the buntings, distinguished by an elongated claw to the thumb, is the *Snow bunting*, as it is found in the northern parts of Great Britain, and is called in Scotland the snow flake. These birds appear there in large flocks, at the commencement of frost, and are feared by many as the harbingers of hard weather; they are about the size of the chaffinch, black above, with a white rump, crown, and forehead. They nestle in holes in rocks, and produce five white eggs, with dusky spots. They are found in all the northern latitudes, as high as navigators have penetrated; nor is it at all apparent by what means they find food in these inhospitable regions. The higher the degree of latitude in which they are found, the whiter, it appears, becomes their plumage; this tendency, which we have had frequent occasion to notice among the mammalia, as well as in the present class, has led to the conclusion that there are many varieties of this species. It breeds in Greenland, visits this country in harvest, and retires in spring. As the winter advances, it approaches the corn-yards, and feeds with the sparrows and finches. In Zetland it is called out-fowl, from the preference which it gives to that kind of grain.

CHAP. V.

OF THE SWALLOW, AND ITS AFFINITIES.

AN idea of any one bird in the former classes will give us some tolerable conception of the rest. By knowing the linnet or the canary-bird we have some notion of the manners of the goldfinch; by exhibiting the history of the nightingale, we see also that of the black-cap or the titmouse. But the swallow tribe seems to be entirely different from all the former; different in their habits, and unlike in all the particulars of their history. In this tribe is to be found the goatsucker, which may be styled a nocturnal swallow; it is the largest of this kind, and is known by its tail, which is not forked, like that of the common swallow. It begins its flight at evening, and makes a loud singular noise, like the whurr of a spinning-wheel.¹ To this also belongs the house-swallow, which is too well known to need a description: the martin, inferior in size to the former, and the tail much less forked; it differs also in its nest, which is covered at top, while that of the house-swallow is open: and the swift, rather larger than the house-swallow, with all the toes standing forward; in which it differs from the rest of its kind.² All these resemble each other so strongly, that it is not without difficulty the smaller kinds are known asunder.

These are all known by their very large mouths,

which, when they fly, are always kept open;³ they are not less remarkable for their short slender feet, which scarcely are able to support the weight of their bodies; their wings are of immoderate extent for their bulk; their plumage is glossed with a rich purple; and their note is a slight twittering, which they seldom exert but upon the wing. This peculiar conformation seems attended with a similar peculiarity of manners. Their food is insects, which they always pursue flying. For this reason during fine weather, when the insects are most likely to be abroad, the swallows are for ever upon the wing, and seen pursuing their prey with amazing swiftness and agility. All smaller animals, in some measure, find safety by winding and turning, when they endeavour to avoid the greater; the lark thus evades the pursuit of the hawk, and man the crocodile. In this manner, insects upon the wing endeavour to avoid the swallow; but this bird is admirably fitted by nature to pursue them through their shortest turnings. Besides a great length of wing, it is also provided with a long tail, which, like a rudder, turns it in its most rapid motions; and thus, while it is possessed of the greatest swiftness, it is also possessed of the most extreme agility.

Early, therefore, in the spring, when the returning sun begins to rouse the insect tribe from their annual state of torpidity; when the gnat and the beetle put off their earthly robes, and venture into air; the swallow then is seen returning from its long migration beyond the ocean, and making its way feebly to the shore. At first, with the timidity of a stranger, it appears but seldom, and flies but slowly and heavily along. As the weather grows warmer, and its insect supply increases, it then gathers greater strength and activity. But it sometimes happens that a rainy season, by repelling the insects, stints the swallow in its food; the poor bird is then seen slowly skimming along the surface of the ground, and often resting after a flight of a few minutes. In general, however, it keeps on the wing, and moving with a rapidity that nothing can escape. When the weather promises to be fair, the insect tribe feel the genial influence, and make bolder flights; at which time the swallow follows them in their aerial journeys, and often rises to imperceptible heights in the pursuit. When the weather is likely to be foul, the insects feel the first notices of it; and from the swallow's following low we are often apprized of the approaching change.⁴

When summer is fairly begun, and more than a sufficient supply for sustaining the wants of nature everywhere offers, the swallow then begins to think of forming a progeny. The nest is built with great industry and art, particularly by the common swallow, which builds it on the

¹ See Supplementary Note C, p. 158.

² See Supplementary Note B, p. 157.

³ This is an error. See Supplementary Note C, p. 158.—Ed.

⁴ See Supplementary Note A, p. 155.

tops of chimneys. The martin sticks it to the caves of houses. The goatsucker, as we are told, builds it on the bare ground. This nest is built with mud from some neighbouring brook, well-tempered with the bill, moistened with water, for the better adhesion, and still farther kept firm by long grass and fibres; within it is lined with goose-feathers, which are ever the warmest and the neatest. The martin covers its nest at top, and has a door to enter at; the swallow leaves hers quite open. But our European nests are nothing to be compared with those the swallow builds on the coasts of China and Coromandel; the description of which I will give in the plain honest phrase of Willoughby. "On the sea-coast of the kingdom of China," says he, "a sort of party-coloured birds, of the shape of swallows, at a certain season of the year, which is their breeding-time, come out of the midland country to the rocks, and from the foam or froth of the seawater, dashing against the bottom of the rocks, gather a certain clammy glutinous matter, perchance the spawn of whales and other young fishes, of which they build their nests, wherein they lay their eggs and hatch their young. These nests the Chinese pluck from the rocks, and bring them in great numbers into the East Indies to sell. They are esteemed by gluttons as great delicacies; who, dissolving them in chicken or mutton broth, are very fond of them; far before oysters, mushrooms, or other dainty and liquorish morsels." What a pity this luxury hath not been introduced among us, and then our great feasters might be enabled to eat a little more.⁵

⁵ All authors are agreed on the estimation in which the Chinese, and other Asiatics, hold the nests of the swallow, called *Salangana*, as a delicacy of the table; but they differ much as to their composition. According to some, the substance of these nests is a sort of froth of the sea, or of the spawn of fish, which is strongly aromatic, though others assert that it has no taste at all; some pretend that it is a kind of gum, collected by the birds on the tree called *Calambone*; others, a viscous humour, which they discharge through the bill at the season of reproduction. The commercial history of these singular nests is much better understood than their composition, in consequence of their reputed virtue as a restorative. The best account of them which we have met with is given by Mr. Crawford. "The best nests," he says, "are those obtained in deep, damp caves, and such as are taken before the birds have laid their eggs. The coarsest are those obtained after the young have been fledged. The finest nests are the whitest; that is, those taken before the nest has been rendered impure by the food and faeces of the young birds. The best are white, and the inferior dark-coloured, streaked with blood, or intermixed with feathers. It may be remarked, however, that some of the natives describe the purer nests as the dwelling of the cock-bird, and always so designate them in commerce. Birds' nests are collected twice a-year; and, if regularly collected, and no unusual injury be offered to the caverns, will produce very equally, the quantity being very little, if at all, improved by the caves being left altogether unmolested for a year or two. Some of the caverns are extremely difficult of access, and the nests can only be collected

The swallow usually lays from five to six eggs, of a white colour, speckled with red; and sometimes breeds twice a-year. When the young brood are excluded, the swallow supplies them

by persons accustomed from their youth to the office. The most remarkable and productive caves in Java, of which I superintended a moiety of the collection for several years, are those of Karang-bolang, in the province of Baglen, on the south coast of the island. There the caves are only to be approached by a perpendicular descent of many hundred feet, by ladders of bamboo and ratan, over a sea rolling violently against the rocks. When the mouth of the cavern is attained, the perilous office of taking the nests must often be performed with torch-light, by penetrating into the recesses of the rock, when the slightest trip would be fatal to the adventurers, who see nothing below them but the turbulent surf making its way into the chasms of the rock. The only preparation which the birds' nests undergo is that of simple drying, without a direct exposure to the sun, after which they are packed in small boxes, usually of a picul (about 135 pounds). They are assorted for the Chinese market into three kinds, according to their qualities, distinguished into first or best, second, and third qualities. Caverns that are regularly managed will afford, in 100 parts, 53 $\frac{2}{10}$ parts of those of the first quality, 35 parts of those of the second, 11 $\frac{7}{10}$ parts of those of the third. The common prices for birds' nests at Canton are, for the first sort, 3,500 Spanish dollars the picul, or £5 18s. 1 $\frac{1}{2}$ d. per pound; for the second, 2,800 Spanish dollars per picul; and, for the third, no more than 1,600 Spanish dollars. In the Chinese markets a still nicer classification of the edible nests is often made than in the island. The whole are frequently divided into three great classes, under the commercial appellation of Paskat, Chikat, and Tung-tung, each of which, according to quality, is subdivided into three inferior orders, and we have, consequently, prices varying from 1,200 Spanish dollars per picul to 4,200. These last, therefore, are more valuable than their weight of silver. Of the quantity of birds' nests exported from the Indian islands, although we cannot state the exact amount, we have data for hazarding some probable conjectures respecting it. From Java there are exported about 200 piculs, or 27,000 lbs., the greater part of which is of the first quality. The greatest quantity is from the Suluk Archipelagos, and consists of 530 piculs. From Macassar there are sent about 30 piculs of the fine kind. These data will enable us to offer some conjectures respecting the whole quantity; for the edible swallows' nests being universally and almost equally diffused from Junk, Ceylon, to New Guinea, and the whole produce going to one market, and only by one conveyance, the junks, it is probable that the average quantity taken by each vessel is not less than the sum taken from the ports just mentioned. Taking the quantity sent from Batavia as the estimate, we know that this is conveyed by 5,300 tons of shipping, and, therefore, the whole quantity will be 1,818 piculs, or 242,400 lbs., as the whole quantity of Chinese shipping is 30,000 tons. In the Archipelago, at the prices already quoted, this property is worth 1,263,519 Spanish dollars, or £284,290. The value of this immense property to the country which produces it, rests upon the capricious wants of a single people. From its nature, it necessarily follows that it is claimed as the exclusive property of the sovereign, and everywhere forms a valuable branch of his income, or of the revenue of the state. This value, however, is, of course, not equal; and depends upon the situation and the circumstances connected with the caverns in which the nests are found. Being often in remote and sequestered situ-

very plentifully, the first brood particularly, when she finds herself capable of producing two broods in a year. This happens when the parents come early, when the season is peculiarly mild, and when they begin to pair soon. Sometimes they find a difficulty in rearing even a single nest, particularly when the weather has been severe, or their nests have been robbed in the beginning of the season. By these accidents, this important task is sometimes deferred to the middle of September.

At the latter end of September they leave us; and for a few days previous to their departure assemble in vast flocks, on housetops, as if deliberating on the fatiguing journey that lay before them. This is no slight undertaking, as their flight is directed to Congo, Senegal, and along the whole Morocco shore. There are some, however, left behind in this general expedition, that do not depart till eight or ten days after the rest. These are chiefly the latter weakly broods, which are not yet in a condition to set out. They are sometimes even too feeble to venture till the setting in of winter; while their parents vainly exhort them to efforts which instinct assures them they are incapable of performing. Thus it often happens that the wretched little families, being compelled to stay, perish the first cold weather that comes; while the tender parents share the fate of their offspring, and die with their new-fledged brood.

Those that migrate are first observed to arrive in Africa, as Adanson assures us, about the beginning of October. They are thought to have performed their fatiguing journey in the space

of seven days. They are sometimes seen, when interrupted by contrary winds, wavering in their course far off at sea, and lighting upon whatever ship they find in their passage. They then seem spent with famine and fatigue; yet still they boldly venture, when refreshed by a few hours' rest, to renew their flight, and continue the course which they had been steering before.

ations, in a country so lawless, a property so valuable and exposed is subject to the perpetual depredations of freebooters; and it not unfrequently happens that an attack upon them is the principal object of the warfare committed by one petty state against another. In such situations, the expense of affording them protection is so heavy, that they are necessarily of little value. In situations where the caverns are difficult of access to strangers, and where there reigns enough of order and tranquillity to secure them from internal depredation, and to admit of the nests being obtained without other expense than the simple labour of collecting them, the value of the property is very great. The caverns of Karangbolang, in Java, are of this description. These annually afford 6,810 lbs. of nests, which are worth, at the Batavia prices of 3,200, 2,500, and 1,200 Spanish dollars the picul, for the respective kinds, nearly 139,000 Spanish dollars; and the whole expense of collecting, curing, and packing, amounts to no more than 11 per cent. on this account. The price of birds' nests is of course a monopoly price, the quantity produced being by nature limited and incapable of being augmented. The value of the labour expended in bringing birds' nests to market is but a trifling portion of their price, which consists of the highest price which the luxurious Chinese will afford to pay for them, and which is a tax paid by that nation to the inhabitants of the Indian islands. There is, perhaps, no production upon which human industry is exerted, of which the cost of production bears so small a proportion to the market price."—*Crawford's Indian Archipelago*.

These are facts proved by incontestable authority; yet it is a doubt whether all swallows migrate in this manner, or whether there may not be some species of this animal that, though externally alike, are so internally different as to be very differently affected by the approach of winter. We are assured from many, and these not contemptible witnesses, that swallows hide themselves in holes under ground, joined close together, bill against bill, and feet against feet. Some inform us, that they have seen them taken out of the water, and even from under the ice, in bunches, where they are asserted to pass the winter, without motion. Reaumur, who particularly interested himself in this inquiry, received several accounts of bundles of swallows being thus found in quarries, and under the water. These men, therefore, have a right to some degree of assent, and are not to lose all credit from our ignorance of what they aver.

All, however, that we have hitherto dissected, are formed within like other birds; and seem to offer no observable variety. Indeed, that they do not hide themselves under water, has been pretty well proved by the noted experiment of Frisch, who tied several threads, dyed in water-colours, round the legs of a great number of swallows that were preparing for their departure; these, upon their return the ensuing summer, brought their threads back with them, no way damaged in their colour; which they most certainly would, if, during the winter, they had been steeped in water; yet still this is a subject on which we must suspend our assent, as Kleim, the naturalist, has brought such a number of proofs in defence of his opinion, that swallows are torpid in winter, as even the most incredulous must allow to have some degree of probability.⁶

⁶ See Supplementary Note D, p. 160.

NOTE A.—*The Swallows.*

The swallow is a general favourite. He comes to us when nature is putting on her most smiling aspect, and he stays with us through the months of sunshine and gladness. "The swallow," says Sir H. Davy, "is one of my favourite birds, and a rival of the nightingale; for he gladdens my sense of seeing, as much as the other does my sense of hearing. He is the joyous prophet of the year, the harbinger of the best season; he lives a life of enjoyment amongst the loveliest forms of nature; winter is unknown to him, and he leaves the green meadows of England in autumn, for the myrtle and orange groves of Italy, and for the palms of Africa." The sentiment is from Anacreon, and it is worthy of the joyousness of the old Grecian:

"Gentle bird! we find thee here
When Nature wears her summer vest;
Thou com'st to weave thy simple nest;
And when the chilling winter lowers,
Again thou seek'st the genial bowers
Of Memphis, or the shores of Nile,
Where sunny hours of verdure smile."

The places which the swallow loves are consecrated, too, by our great dramatic poet, in one of his most characteristic passages, in which, after the turmoil of dark passions, the mind is for a moment relieved by the contrast of pure feelings, clothed in the most exquisite language.

"This guest of summer,
The temple-haunting martlet, does approve
By his loved mansionry, that the heaven's breath
Swells wooingly here: no jetty, frieze, buttress,
Nor coign of vantage, but this bird hath made
His pendant bed, and procreant cradle: where they
Most breed and haunt, I have observed the air
Is delicate."

But the attractions of poetry are not required to give a charm to the "loved mansionry" of this delightful bird. It is the voice of innocent gladness; the bird is happy, as it seems to us, because it is constantly active in its proper duties. The swallow's nest, though it may appear to deform the trim mansion, is seldom disturbed, even though the old pious feeling towards the bird has passed away. A writer in the 'Gentleman's Magazine' says, "for my part I am not ashamed to own, that I have tempted window-swallows to build round my house, by fixing scollop shells in places convenient for their 'pendant beds and procreant cradles;' and have been much pleased in observing with what caution the little architect raises a buttress under each shell, before he ventures to form his nest on it."

Some less poetical however, it would appear, have a dislike to the window-swallow, and have even gone so far as to endeavour to banish it by preventing it from building. In this vein, we are instructed by a recent periodical writer, how to discard them. It appears, he says, from experiments made at Granton, that if the places in the corners of windows and under eaves, where the swallows build, are well rubbed with oil and soft soap, they will not be able to make their clay adhere to the wall, and being once foiled, they will not renew their attempt for some years afterwards. The Anglo-Americans have many contrivances for enticing birds to build near their houses. Being peculiarly partial to the barn-swallow, they fix up boxes for it to nestle in. This species is considerably different from our chimney-swallow, and is of a bright chestnut colour on the belly and vent, where ours is pure white; but it resembles it in its habits of nesting on the rafters or beams of sheds, barns, and other outhouses, though not in chimneys.

Wilson has given some interesting characteristic traits in the history of this bird. "On the 16th of May," says he, "being on a shooting expedition on the top of Pocano mountain, Northampton, when the ice on that and on several successive mornings was more than a quarter of an inch thick, I observed with surprise a pair of these swallows which had taken up their abode on a miserable cabin there. It was about sunrise, the ground was white with hoarfrost, and the male was twittering on the roof, by the side of his mate with great sprightliness. The man of the house told me, that a single pair came regularly there every season, and built their nest on a projecting beam under the eaves, about six or seven feet from the ground. At the bottom of the mountain, in a large barn belonging to the tavern there, I counted upwards of twenty nests, all seemingly occupied. In the woods they are never met with; but as you approach a farm they soon catch the eye, cutting their gambols in the air. Scarcely a barn, to which these birds can find access, is without them; and as public feeling is universally in their favour,

they are seldom or never disturbed. The proprietor of the barn last mentioned, a German, assured me, that if a man permitted swallows to be shot, his cows would give bloody milk, and also, that no barn where swallows frequented would ever be struck with lightning. "Early in May," continues Wilson, "they begin to build. From the size and structure of the nest, it is nearly a week before it is completely finished. One of these nests, taken on the 21st of June from the rafter to which it was closely attached, is now lying before me. It is in the form of an inverted cone, with a perpendicular section cut off on that side by which it adhered to the wood. At the top, it has an extension of the edge or offset, for the male or female to sit on occasionally, as appeared by the dung; the upper diameter was about six inches by five, the height externally seven inches. This shell is formed of mud, mixed with fine hay, as plasterers do their mortar with hair, to make it adhere the better; the mud seems to have been placed in regular strata or layers, from side to side; the hollow of this cone (the shell of which is about an inch in thickness) is filled with fine hay, well stuffed in; above that is laid a handful of very large downy geese feathers. Though it is not uncommon for twenty and even thirty pair to build in the same barn, yet everything seems to be conducted with great order and affection; all seems harmony among them, as if the interest of each were that of all. Several nests are often within a few inches of each other; yet no appearance of discord or quarrelling takes place in this peaceful and affectionate community." Wilson was in error when he supposed that the chimney-swallow is distinguished from his barn-swallow by never building in barns and outhouses. In Scotland, on the contrary, these are its chosen haunts, and there it more rarely builds in chimneys than in England. In Sweden it is the same, and hence it is called the Barn-swallow (*Laduswala*); while in the south of Europe, where chimneys are rare, it builds in gateways, porches, and galleries, or against the rafters of outhouses, as in Virgil's time:

"—Ante
Garrula quam tignis iudum suspendat hirundo."

When a chimney is selected, it seems to prefer one where there is a constant fire, most probably for the sake of warmth. "Not," remarks White, "that it can subsist in the immediate shaft, where there is a fire, but prefers one adjoining to that of the kitchen, and disregards the perpetual smoke of that funnel, as I have often observed with some degree of wonder. Five or six or more feet down the chimney, does this little bird begin to form her nest about the middle of May, which consists, like that of the window-swallow, of a crust or shell composed of dirt or mud, mixed with short pieces of straw to render it tough and permanent; with this difference, that whereas the shell of the former is nearly hemispheric, that of the latter is open at the top, and like half a deep dish: this nest is lined with fine grasses and feathers, which are often collected as they float in the air. Wonderful is the address which this adroit bird shows all day long in ascending and descending with security through so narrow a pass. When hovering over the mouth of the funnel, the vibrations of her wings, acting on the confined air, occasion a rumbling like thunder. It is not improbable that the dam submits to this inconvenient situation, so low in the shaft, in order to secure her broods from rapacious birds, and particularly from owls, which frequently fall down chimneys, perhaps in attempting to get at these nestlings." It might not be readily supposed that a bird, thus building in an elevated chimney, would have thought of going under ground for a nestling place; yet they very commonly build in the shafts of coal-pits.

The window-swallow is no less celebrated than the chimney-swallow, for selecting singular situations. M. Hebert saw a pair build on the spring of a bell, the bottom of the nest resting on the spring, while the upper semicircular brim leaned against the wall by its two ends, three or four inches below the eave. The two birds, during the time they were employed in the construction, passed the nights on the iron spike to which the spring was fastened. The frequent concussion given by the spring could not fail to disturb the action of nature in the development of the young, and the hatch, accordingly, did not succeed; yet would not the pair forsake their tottering mansion, but continued to inhabit it for the rest of the season. The semicircular form, which on this occasion was given to the nest, proves that these birds can, upon occasion, change the usual arrangement of their architecture. Another pair, mentioned by Bingley, built for two successive seasons on the handles of a pair of garden-shears, which had been stuck up against the boards of an outhouse. A still more singular instance is recorded of another pair, which built their nest on the wings and body of a dead owl, hung up on the rafter of a barn, and so loose as to be moved by every gust of wind. This owl, with the nest on its wings, and the eggs in the nest was brought as a curiosity to the museum of Sir Ashton Lever, who, struck with the oddity of the thing, desired a large shell to be fixed up where the owl had hung; and the following season a nest, as had been anticipated, was built there, and was transmitted to the Leverian museum as a companion to the owl.

The chimney-swallow differs from the window-swallow, according to Montbeillard, in not occupying the same nest more than one season, building annually a new nest, and, if the spot admits it, fixing it above that occupied the preceding year. "I have found them," says he, "in the shaft of a chimney, thus ranged in tiers, and have counted four, one above another, and all of equal size, plastered with mud mixed with straw and hair. There were some of two different sizes and shapes,—the largest resembled a shallow half-cylinder, open above, a foot in height, and attached to the sides of the chimney; the smallest were stuck in the corners of the chimney, forming only a fourth of a cylinder, or almost an inverted cone. The first nest, which was the lowest, had the same texture at the bottom as at the sides; but the two upper tiers were separated from the lower by their lining only, which consisted of straw, dry herbs, and feathers. Of the small nests, built in the corners, I could find only two in tiers, and I inferred that they were the property of young pairs, as they were not so compactly built as the larger ones."

NOTE B.—The Swift.

The swift (*Cypselus murarius*) arrives in Britain from the 20th of April to the beginning of May. It has been stated by Mr. Selby, that "it is seldom seen in the northern parts of England before the end of May, or the beginning of June;" but this appears to be a mistake, for in Edinburgh it always comes before the 5th of May, and even in the very severe weather of 1837, it was seen at Newington and Canonmills on the 3d of that month. It is not in general, however, until after the different species of swallow have made their appearance that it presents itself, a few individuals only being seen at first, and the number gradually increasing until at length they become in many places plentiful, and attract attention by their extremely rapid flight and loud screams. The plumage is perfect at the period of its arrival, and it does not moult during its sojourn in this country.

The general form of the swift is rather full; the

body somewhat depressed, the neck very short; the head broad; the bill extremely small, but expanded at the base; the feet remarkably short, but strong; the tarsus anteriorly feathered; the four toes nearly of equal length, and all directed forwards; the claws very strong and curved; the wings are exceedingly long and sickle-shaped; the tail forked. The bill, feet, and eyes, are black; the colour of the plumage is blackish-brown, generally glossed with greenish, the throat whitish. The length of the male is seven and a half inches; the extent of its wings sixteen and a half.

The swift betakes itself to steeples, high towers, ruinous castles, and abrupt rocks, where it nestles in the holes and crevices. At early dawn, in fine weather, it is to be seen shooting through the air in all directions, with a rapidity scarcely equalled by that of any other bird. Its flight is performed by quick flaps of its long narrow wings, alternating with long glidings or sailings, during which these organs seem motionless, but extended at a moderately open angle. If you watch an individual, you observe it speeding away with quick motions of its wings, which, being raised and depressed over a great range, seem to alternate with each other, although this is not in reality the case, all birds moving their wings synchronously. There it shoots along, turns to the right and left, flutters for a moment, ascends, comes down abruptly, curves and winds in various direction, darts in among its fellows, and is lost to your view. The ease with which it rises, falls, bends to either side, glides in short or long curves, or stops in the midst of its full career, is less astonishing than it ought to be, familiarity in this, as in other instances, producing a disposition to regard as simple what is the result of elaborate mechanism. It continues searching the air in this manner all day long, when the weather is good; nor does a shower, however heavy, usually induce it to relinquish its pursuit. Even in the midst of heavy thunder-rains, it may often be seen wheeling and diving with unremitting vigour, and in drizzly weather, when the swallows have disappeared, it pursues its avocations, heedless of the damps. In dry and sunny weather, however, it generally rests in the middle of the day, and towards evening is extremely active, filling the air with its shrill and joyous screams. Its food consists entirely of insects, which it seizes exclusively on wing. Several curious circumstances may be noted with reference to its pursuit of these animals. In rainy or damp coldish weather, the swifts are to be found flying, at no great height, generally from ten to fifty or sixty yards, frequently in bands of twenty or more, often shooting along the sides of the hedges, descending in curves, and skimming the surface of the grass, wheeling, circling, and performing all sorts of evolutions. On such occasions, they are easily shot, for they often come quite close to the gunner, being altogether heedless of his presence, so intent are they on capturing their prey. In fine weather, they fly low in the mornings and evenings, and are among the first birds that come abroad, and the latest in retiring to their places of repose; but during the greater part of the day they are to be seen chiefly at a great elevation, apparently that of several hundred yards. These birds fly high or low, according as their prey is abundant in the higher parts of the air, or near the surface of the ground or woods; and as insects fly lower in the evening and morning, or in damp weather, so the swifts then descend.

In dry sunny weather they frequently utter a loud shrill scream, as they pursue their prey; but not in such weather only, for you often hear it before or during rain, especially in the evening. Some have fancied this scream to be an intimation given by the male to his mate that he is at hand, and others that it is caused by the excitement of electricity;

but these conjectures are destitute alike of ingenuity and truth. It is not in thundery weather alone that swifts scream, but often in the clear, dry, and sunny skies, that exhibit no phenomena indicative of a want of electric equilibrium. And, as to the other theory, it suffices to reflect that swifts scream as frequently over the open fields, at the distance of a mile or more from their resting-places, as when wheeling near steeples or towers. The cry of jackals, wolves, and hounds, when in full chase, seems to be analogous to the scream of swifts under similar circumstances, but the cause and use of either is not satisfactorily ascertained. Single birds seldom scream, and the loudest and most frequent cries are heard when birds are evidently in active and successful pursuit. It is so with terns, gulls, and even gannets; and when you see these birds hovering over the sea, and hear their mingling cries, you may be sure that they have discovered a shoal of fishes, and are enjoying their good fortune. They seem to scream or cry out from pleasure, and thus give intimation to their fellows of the plentiful existence of food. As to the organ of this loud and shrill scream in the swift, namely, the trachea, it is short, remarkably flattened, and gradually diminishes in diameter to the bifurcation. It has no song nor twitter, like the swallows.

If we suppose that the swift is destined to feed exclusively on insects as they flutter in the air, which is in fact the case, we can be at no loss to trace the reason of its peculiar form. Its body is light, but moderately stout, and its pectoral muscles are large, otherwise it could not move its wings with the requisite strength and rapidity. The wings are extremely elongated and narrow, because great rapidity of flight is required in the pursuit of animals which themselves fly with speed, and because sudden turns require to be executed in seizing them. A short, broad, concave wing, as that of a partridge, on being rapidly moved, produces considerable velocity, but is not fitted for either buoyant gliding or quick evolution. For the latter, the surface of the wing must be extended in length and narrowed, and instead of presenting a concavity, must be straight in the horizontal direction. Accordingly, in the swift, the wing has its humeral articulation peculiarly free, inasmuch that, holding one alive in your hand, you at first imagine that its wings have been broken. At the same time, their muscular apparatus is remarkably strong. Then the secondary quills are very short, and the primaries gradually and rapidly elongated, and furnished with very strong, but highly elastic shafts. The tail, although not so long, is similarly constructed, being deeply forked, and so in a manner divided into two pointed and elongated laminae, similar in some degree to the wings, and aiding their action in executing turns. In seizing its prey, while gliding or fluttering in the air, the bird would be incommoded by any length of neck; that part is, therefore, extremely abbreviated, so that the head seems as if stuck upon the shoulders, as is the case, for a similar reason, in the cetacea and fishes. A long pointed bill would be of use only to a bird that has objects to peck from the ground or any other surface, or from among soil or foliage. In the present case, the bird, carried with rapidity to its tiny prey, merely requires to open its mouth, which is extremely enlarged, and supplied with an abundant viscid secretion, which immediately entangles the fly that has been caught, and prevents its escape, should the mouth be opened the next instant. A bird so living has no need of walking, and there being nothing superfluous in nature, its feet are reduced to cramping organs, by which it can cling to any kind of surface when entering its nest, and its gait is merely a hobbling motion, aided by the wings. It cannot rise from a flat surface, but it launches from any little eminence, and if it can spring

out horizontally is enabled to fly off, although its usual mode of launching is, like that of the gannet, by a deep curve. These two birds are very similar in some points of their organization. Their wings are long and narrow, and their flight is rapid and buoyant; they seize their prey by throwing themselves with velocity upon it; they launch from the rocks in the same manner; and exhibit other points of mutual resemblance; as do the terns more especially, which, on account of their form and buoyant flight, have received the vulgar appellation of *sea-swallows*.

The want of walking feet might be supposed to be somewhat inconvenient on many occasions. Thus, when the bird has its nest to make, it must gather straws and feathers; but so great is its dexterity on wing, that it pecks them up with ease as it sweeps along. The nest is placed in the crevice of a wall or rock, in a steeple or tower, in holes under the eaves, or in some such place, at as great a height as possible, and is composed of twigs, straws, and feathers, being bulky, but shallow, and not neatly arranged. The eggs are two or three, of an elongated form, pure white, their average length one inch, their greatest breadth seven and a half twelfths. They are deposited from the beginning to the middle of June, and the young are abroad by the end of July. Only one brood is reared in the season. The swifts take their departure from the middle to the end of August, thus residing with us only three months and a half. As the insects on which they live are generally very small, they do not swallow each as it is caught, but collect a number previously to the act of deglutition, for at whatever period they are shot, one generally finds insects in their mouth. When collecting food for their young, they do not return to the nest so frequently as the swallows, but accumulate a considerable quantity at a time. The insects on which they feed are numerous species of Coleoptera, Ephemera, Phryganea, and occasionally Libellula and Musca. It has been conjectured by some that the viscid saliva of the swallows is used for agglutinating the pellets of which the outer crust of their nests is composed: but the sand-swallow, which has no such crust to its nest, has an equally copious viscid saliva. The same is the case with the swift.

The young swifts are of a dusky colour, at first blind, and almost naked, having merely a few straggling tufts of down. When fully fledged, they are of the same colour as the adults, but of a lighter tint, with the edges of the feathers of the head paler. Previous to their departure, the swifts do not collect into large flocks, like the swallows, but disappear gradually, setting out apparently in small parties, in the same manner as that in which they arrived.

NOTE C.—*The Goatsucker.*

The goatsucker or nightjar arrives in this country from the middle to the end of May, being among the latest of our summer visitants, and departs about the end of September. It is generally distributed, but is nowhere very common, and in many large tracts is not met with. Dr. Edward Moore states, that it is "common about the South Hams of Devonshire, where they frequent orchards," and Mr. Barclay has met with it near Elgin. It is chiefly found on furzy commons, wild bushy heaths, and broken hilly ground covered with ferns, especially in the neighbourhood of thickets and woods. It is rarer in Scotland than in England, which is the reverse with the cuckoo, a bird in some respects similar in its habits, and which appears to be much more plentiful in the wild valleys of the north than in the cultivated plains of the south.

The bill of this bird is extremely small and feeble,

the mouth excessively wide, the palate flat, covered with a smooth membrane, which is transparent, as are in some measure the bones. The tongue is very small and triangular. The gullet is rather wide, the stomach large, round, membranous, its muscular coat being composed of fasciculi, as in the owls and cuckoos, the intestine short, the cæcal appendages small. The eyes are very large, as are the apertures of the ears. The head is very large, depressed, and flattened above. The feet are extremely small; the tarsus very short, anteriorly feathered, except at its lower part: the first toe very short, slender, and directed inwards, the second and fourth about equal, the third much longer, the anterior toes connected by membranes as far as the second joint; the claws very small, arched, and compressed; that of the middle toe is proportionably longer, and has its inner convex edge expanded and pectinated, being cut in two by parallel slits. The plumage is full and blended; the wings very long and narrow; the tail very long, often broad, rounded feathers. The bill and claws are dusky, the feet flesh-coloured; the general colour of the upper parts is ash-gray, minutely dotted and undulated with dusky, and variegated with brownish-black, and pale yellowish-red, the head and back being marked with elongated spots of the latter colour. On the inner webs of three of the primaries is a large roundish white spot; the two lateral tail-feathers have also a large patch of white at the end. The lower parts are transversely barred with dull reddish-yellow and dusky; and on the throat are some white feathers. The length is eleven inches, and the extended wings measure twenty-three.

This unfortunate bird has a strong claim on our sympathy, on account of the manner in which all its actions and habits have been misrepresented. The ancients accused it of milking goats, and thus it received the names of *caprimulgus* and *goatsucker*, which it retains to the present day. Then it was alleged to be so awkward as to be obliged to fly with its mouth wide open, and so slovenly as to need an instrument on its foot with which to cleanse its chops. Lastly, so malignant were its traducers, as to hint that it could not see like other creatures, but was obliged to gape widely, and then turn its eyes downward to look through the roof of its mouth, for which purpose that part was made thin and transparent. The substances which Mr. Macgillivray found in the stomach of this bird were remains of coleopterous insects of many species, lepidoptera, and sometimes larvæ. Towards evening the goatsucker may be seen skimming along the edges of woods with a light and buoyant flight, winding in varied curves, in the manner of a swallow, but with less velocity, and by its noiseless motions also reminding the observer of the owls. As it proceeds, it now and then emits a shrill squeaking cry. It is seldom that more than one or two individuals are seen at a time; but Montagu remarks that he observed "in Scotland eight or ten on wing together in the dusk of the evening, skimming over the surface of the ground in all directions, like the swallow, in pursuit of insects." During the day it generally rests on the ground, among furze or fern, or on the branch or bough of a tree, on which it reposes in a direction parallel to its axis. This arises from the disposition of the toes, which is such, that it cannot securely grasp a branch in the ordinary way. When disturbed while on the ground, it flies off with a wavering buoyant flight, and generally alights on a tree, if there be one in the neighbourhood.

The eggs, which are two in number, broadly elliptical, whitish and clouded with ash-gray and brown, are deposited on the bare ground, among furze, heath, or fern. The young are densely covered with long whitish down. During the breeding season, accord-

ing to Montagu, "it makes a singular noise, like the sound of a large spinning wheel, and which it is observed to utter perched, with the head lowermost."

The serrature of the middle claw of this and the other species has elicited various conjectures as to the use of so curious a structure. Several persons have supposed or imagined it to be for the purpose of enabling the bird to clear away from between the bristles that fringe its mouth, the fragments of wings or other parts of lepidopterous insects, which, by adhering, have clogged them. This at first sight seems a remarkably plausible account of the matter, but a very little reflection, with a slight inspection of the parts, will suffice to show its futility. The bristles are large, strong, and placed at some distance from each other. The teeth of the claw are extremely thin, and very close, being separated only by mere chinks. The claw then cannot act as a comb, because one of the bristles is as broad at the base as two or three of the teeth, so that it cannot enter between them; and although it tapers away toward the end, yet even there it is too wide to be insinuated. But, although the claw may not act as a comb, it may be said that its serrated edge will more readily than a continuous edge catch hold of any thing stuck between the bristles. This is likely enough; but then the species of the genus *podargus* or strong-billed goatsuckers have similar bristles, but are destitute of clefts on the claw. Gannets, herons, and other birds, that have no bristles, have yet a serrated claw; therefore, the serrature is not intended for the purpose of clearing the bristles. Yet it may be quite true that the goatsucker uses its claw to produce that effect; but it is not less true that parrots, finches, and other birds, having no such serrature, employ their claws for scratching the parts about the head. And so another reason must be sought for. The young goatsucker has at first no serrature on its claw, any more than the young gannet. One fully fledged, and shot about the end of September, now before me, has the toe scarcely half the length of that of an old bird, and with only five teeth, the old bird having ten. The chinks in the young bird's claw are less deep than those in that of the old bird. A young fledged gannet shows the same circumstance. All birds whose middle claw is serrated, have that claw elongated, and furnished with a very thin edge. It therefore appears that the serration is produced by the splitting of the edge of the claw, after the bird has used it, but whether in consequence of the pressure caused by standing or grasping can only be conjectured. The flycatchers, and other birds of the same family, which have strong bristles, intended for the same use, have not serrated claws; yet if their bristles become clogged, they no doubt will clean them in the same manner. It appears that the use of the serratures is not that of clearing the bristles of the scales of lepidopterous insects, because fish-eating birds without any bristles have similar serratures; but there is no reason for doubting that goatsuckers brush away adherent matter with their claws, just as other birds do, the domestic fowl, for example. Another supposition is, that the serrature enables the goatsucker to hold more securely a large insect which it has caught with its foot. And observers have stated that they have been pretty sure of having seen that bird, when flying, raise its foot to its mouth, as if, in the manner of a parrot, to carry to it an insect. It may be so; but as yet no one has quite satisfactorily seen a goatsucker catch a moth or a beetle with its foot; and this cannot be the use of the serrature, for the gannet and heron, which do not seize their prey with their feet, have serrated claws. The notion of a bird's flying with open mouth, for the purpose of seizing its prey, is preposterous. It has been alleged that swifts and swallows do so; but Mr. Macgillivray has satisfactorily ascertained that they

do not; and there is no reason to suppose that goat-suckers are so awkward as to require to keep their jaws constantly wide open lest their prey should escape them. But the most absurd notion of all is that expressed by Mr. Selby as follows: "The membrane that lines the inside of the mouth is very thin and transparent, particularly opposite to the posterior part of the eye, which organ is pretty clearly discernible through the membrane. As the mouth opens to such great lateral extent, it has been suggested that the bird may possibly be capable of turning the eye in its socket, so far as to look through this almost transparent veil in a straightforward direction, when the mouth is extended in its nocturnal flights. I have consequently directed my attention to this point, but as yet without any satisfactory result." Indeed, it was unworthy of exercising the observation of so sagacious an ornithologist. How desperately imaginative must those persons be, who, not content with allowing a bird to seize its prey like other birds, by opening its bill when it comes up to it, must represent it as flying about with its mouth wide open, and instead of using its eyes as all other birds use them, turning them round, to the imminent danger of separating the optic nerve, so as to spy moths and beetles through a window in the palate!

NOTE D.—*Popular errors regarding the torpidity of Swallows.*

It has long been, and continues to be, a popular opinion in this country, and in other parts of Europe, that swallows of a certain species pass the winter at the bottoms of deep lakes and wells. The analogy between birds of passage, and animals which remain in a state of torpidity during the winter, is most inaccurately drawn by Goldsmith; and we offer the following objections to the supposed constitutional connexion.

Those quadrupeds, birds, reptiles, and insects, which pass the winter in a state of insensibility, may be recalled to sensation and action at pleasure, by the application of a gentle degree of heat. Naturalists have been induced, from this constitutional singularity of these animals, to conclude, that the return of spring rouses them from their lethargic state to enjoy the pleasures of sensation and locomotion. The animals in question take up their abodes a little below the surface of the soil, some in the crevices of walls, or interstices of rocks; while others, such as frogs, toads, and water-newts, bury themselves in the mud of shallow ponds. In the first of these retreats, they are only covered by a thin layer of earth and moss, or leaves; and in the last, by the addition of a shallow sheet of water; consequently they are reanimated in due season, by the genial rays of the sun; after he has entered the northern half of the ecliptic.

The temperature of places, situate at great depths below the surface of the land and water, is a sufficient objection to the assertion that birds remain in a torpid state, during the winter, in deep and solitary caverns, or at the bottom of deep lakes. Dr. Hale has proved, by experimental facts, that the bulb of a thermometer, buried sixteen inches below the earth's surface, stood at 25° of his scale in September, at 16° in October, and at 10° in November, during a severe frost; from which point it ascended again slowly, and reached 23° in the beginning of April. Now the end of September and beginning of October is the season when the hedgehog, shrew, bat, toad, and frog, disappear; and, about the middle of April, these animals re-appear: this agrees very well with the variations of temperature of the preceding theory. It is a well-established fact, that all places situate eighty feet below the surface of the earth are constantly of the same temperature. Mr. Boyle kept a thermometer for a year under a roof of earth, eighty

feet in thickness, and found that the fluid in the instrument remained stationary all the time. Dr. Withering made a similar experiment on a well eighty-four feet deep, and found that it remained at 49° for the entire year. Surely, then, this invariable temperature is inconsistent with the theory of birds remaining in a state of torpidity in deep lakes, or solitary caverns, where the sun has no influence; for what would call forth their dormant organs into action, the sun having no influence in places so situate? It is but reasonable to conclude, that the cold, which kept them benumbed by its soporific influence, would perpetuate their slumber.

The state of torpor to which hibernating animals are annually subjected, is obviously analogous to sleep, but it differs from sleep in being occasioned solely by temperature. Hibernating animals always assume this torpid condition, whenever the thermometer sinks to a certain point. Man, and almost all animals, seem to be susceptible of this state, at least to a certain extent; for the apparent death produced by cold is probably nothing else but a species of torpor, out of which the animal, in most cases, might be roused if the requisite precautions in applying heat were attended to; for death, in most cases, seems to be produced, not by the cold, but by the incautious and sudden application of heat, which bursts the blood-vessels in some particular part of the body, before the heat has had the power of stimulating the heart, and setting the blood in motion through the whole animal frame; and this bursting of the blood-vessels destroys the texture of the body. It is well known that if any part of the body be frost-bitten, an incautious application of heat infallibly produces mortification, and destroys the part. In the 28th volume of the 'Philosophical Transactions,' there is a remarkable example recorded of a woman, almost naked, lying buried for six days under the snow, and yet recovering. In this case it is scarcely possible to avoid supposing that the woman must have been in a state of torpor, otherwise she would have endeavoured to find her way home.

That a few stragglers of the swallow tribe do remain in this country long after their fellows have departed, there can be no doubt; and even some have been known to sojourn during the whole winter: but, it is equally true that the uniform habit of these birds is to quit the north on the approach of winter, and to seek climates more congenial to their mode of existence, which is entirely maintained by insect food.

The Rev. Gilbert White, in his interesting 'Natural History of Selborne,' remarks, "I cannot agree with those persons who assert that the swallow kind disappear some and some, gradually, as they come, for the bulk of them seem to withdraw at once; only some stragglers stay behind a long while, and do never, there is the greatest reason to believe, leave this island. Swallows seem to lay themselves up, and to come forth in a warm day, after they have disappeared for weeks. For a very respectable gentleman assured me, that as he was walking with some friends under Merton-wall, on a remarkably hot noon, either in the last week of December or the first week in January, he espied three or four swallows huddled together on the moulding of one of the windows of that college. I have frequently remarked that swallows are seen later at Oxford than elsewhere. Is it owing to the vast massy buildings of that place, to the many waters round it, or to what else?" He also mentions that a friend of his saw a marten on the 26th November, in a sheltered bottom; the sun shone warm, and the bird was hawking briskly after flies. Mr. Sweet mentions the circumstance of a house swallow having taken up its residence, late in the autumn, within St. Mary's church at Warwick; it was regularly observed there by the

congregation until Christmas-eve; after which, it disappeared and was seen no more.

CHAP. VI.

THE HUMMING-BIRD, AND ITS VARIETIES.

HAVING given some history of the manners of the most remarkable birds of which accounts can be obtained, I might now go to a very extensive tribe, remarkable for the splendour and the variety of their plumage: but the description of the colours of a beautiful bird has nothing in it that can inform or entertain; it rather excites a longing, which it is impossible for words to satisfy. Naturalists, indeed, have endeavoured to satisfy this desire by coloured prints; but, beside that these at best give only a faint resemblance of nature, and are a very indifferent kind of painting, the bird itself has a thousand beauties that the most exquisite artist is incapable of imitating. They, for instance, who imagine they have a complete idea of the beauty of the little tribe of manikin birds, from the pictures we have of them, will find themselves deceived when they compare their draughts with nature. The shining greens, the changeable purples, and the glossy reds, are beyond the reach of the pencil; and very far beyond the coloured print, which is but a poor substitute to painting. I have therefore declined entering into a minute description of foreign birds of the sparrow kind; as sounds would never convey an adequate idea of colours.

There is one species, however, that I will conclude the history of this class with; as, though the least, it will certainly be allowed the most beautiful of all others. In quadrupeds, the smallest animals are noxious, ugly, and loathsome; the smallest of birds are the most beautiful, innocent, and sportive. Of all those that flutter in the garden, or paint the landscape, the humming-bird is the most delightful to look upon, and the most inoffensive.

Of this charming little animal there are six or seven varieties, from the size of a small wren down to that of an humble-bee. A European could never have supposed a bird existing so very small, and yet completely furnished out with a bill, feathers, wings, and intestines, exactly resembling those of the largest kind. A bird not so big as the end of one's little finger would probably be supposed but a creature of imagination, were it not seen in infinite numbers, and as frequent as butterflies in a summer's day, sporting in the fields of America, from flower to flower, and extracting their sweets with its little bill.

The smallest humming-bird is about the size of a hazel-nut. The feathers on its wings and tail are black; but those on its body, and under

its wings, are of a greenish brown, with a fine red cast, or gloss, which no silk or velvet can imitate. It has a small crest on its head, green at the bottom, and, as it were, gilded at the top; and which sparkles in the sun like a little star in the middle of its forehead. The bill is black, straight, slender, and of the length of a small pin. The larger humming-bird is near half as big as the common wren, and without a crest on its head; but, to make amends, it is covered, from the throat half way down the belly, with changeable crimson-coloured feathers, that, in different lights, change to a variety of beautiful colours, much like an opal. The heads of both are small, with very little round eyes, as black as jet.

It is inconceivable how much these add to the high finishing and beauty of a rich luxurious landscape. As soon as the sun is risen, the humming-birds, of different kinds, are seen fluttering about the flowers, without ever lighting upon them. Their wings are in such rapid motion, that it is impossible to discern their colours, except by their glittering. They are never still, but continually in motion, visiting flower after flower, and extracting its honey as if with a kiss. For this purpose they are furnished with a forked tongue, that enters the cup of the flower, and extracts its nectared tribute. Upon this alone they subsist.¹ The rapid motion of their wings

¹ "From the circumstance of numming-birds frequenting flowers, and thrusting their needle-formed bills into the blossoms, as bees and butterflies do their suckers (haustella), it has hastily been concluded by naturalists, that, like these insects, they feed on honey. But if such naturalists had paused for a moment to consider the form of the bill and the tongue in the trochilidæ, their conclusions would not perhaps have been so hasty. The trophi of insects which feed on the honey of flowers, are beautifully adapted for procuring it by suction, which is commonly indispensable, the honey being in most cases spread thinly over the surface of the nectary or the ungulae of the petals, and not in quantities such as it might be drunk like water. Now it is a fact, which is or may be well known, that birds have almost no power of suction, in consequence of the narrowness and rigidity of their tongue, as may be seen when they drink, having to hold up their heads and depend upon the weight of the water for transmitting it into the craw. Nobody, as far as we know, has described the humming-bird drinking the honey from flowers in this manner, and indeed its tenacity and glutinous nature would entirely preclude this. Such reasons would dispose us, therefore, to conclude, that the trochilidæ do not feed on honey, though we did not possess irresistible proof of the fact that they feed on insects. Wilson, the distinguished author of the 'American Ornithology,' found, upon repeated dissection, that the *Trochilus colubris* had a quantity of insects in its stomach, either whole or in fragments; and the eccentric Waterton affirms that humming-birds feed on insects. Of course, they frequent flowers not for their honey, but to prey upon the insects which are in pursuit of this honey. Were the requisite scrutiny gone into, it is probable that we should find all Latham's 'Flower-eaters' (*anthophagi*) and Temminck's 'Nectarinæ' exclusively feeding on insects."—J. Rennie.

brings out a humming sound, from whence they have their name; for whatever divides the air swiftly, must thus produce a murmur.

The nests of these birds are not less curious than the rest; they are suspended in the air, at the point of the twigs of an orange, a pomegranate, or a citron tree; sometimes even in houses, if they find a small and convenient twig for the purpose. The female is the architect, while the male goes in quest of materials; such as cotton, fine moss, and the fibres of vegetables. Of these materials a nest is composed, of about the size of a hen's egg cut in two, admirably contrived, and warmly lined with cotton. They lay two eggs at a time, and never more, about the size of small peas, and as white as snow, with here and there a yellow speck. The male and the female sit upon the nest by turns; but the female takes to herself the greatest share. She seldom quits the nest, except a few minutes in the morning and evening when the dew is upon the flowers, and their honey in perfection. During this short interval, the male takes her place; for, as the egg is so small, the exposing it ever so short a time to the weather would be apt to injure its contents, the surface exposed being so great in comparison of the bulk. The time of incubation continues twelve days; at the end of which the young ones appear, much about the size of a blue-bottle fly. They are at first bare; by degrees they are covered with down; and at last feathers succeed, but less beautiful at first than those of the old ones.

"Father Labat's companion in the mission to America, found the nest of a humming-bird in a shed that was near the dwelling-house, and took it in at a time when the young ones were about fifteen or twenty days old; he then placed them in a cage at his chamber-window, to be amused by their sportive flutterings; but he was soon surprised to see the old ones, that came and fed their brood regularly every hour in the day. By these means they themselves soon grew so tame that they seldom quitted the chamber; but without any constraint came to live with their young ones. All four have frequently come to perch upon their master's hand, chirruping as if they had been at liberty abroad. He fed them with a very fine clear paste, made of wine, biscuit, and sugar; they thrust their tongues into this paste till they were satisfied, and then fluttered and chirruped about the room. I never beheld anything more agreeable," continues he, "than this lovely little family that had taken possession of my companion's chamber, and that flew out and in just as they thought proper; but were ever attentive to the voice of their master, when he called them. In this manner they lived with him for above six months; but at a time when he expected to see a new colony formed, he unfortunately forgot to tie up their cage to the ceiling at night to preserve them from the rats, and he found they were devoured in the morning."

These birds on the continent of America continue to flutter the year round; as their food, which is the honey of flowers,² never forsakes them in those warm latitudes where they are found. But it is otherwise in the islands of the Antilles, where, when the winter season approaches, they retire, and, as some say, continue in a torpid state during the severity of that season. At Surinam and Jamaica, where they constantly have flowers, these beautiful birds are never known to disappear.

It is a doubt whether or not these birds have a continued note of singing. All travellers agree that, beside the humming noise produced by their wings, they have a little interrupted chirrup; but Labat asserts, that they have a most pleasing melancholy melody in their voices, though small, and proportioned to the organs which produce it. It is very probable that, in different places, their notes are also different; and as there are some that continue torpid all the winter, there may likewise be some with agreeable voices, though the rest may in general be silent.

The Indians formerly made great use of this bird's plumage, in adorning their belts and head-dress. The children take them in the fields upon rings smeared with birdlime; they approach the place where the birds are flying, and twirling their rings in the air, to allure them, either by the colour or the sound, that the simple little creature comes to rest upon the ring, and is seized. They are then instantly killed and gutted, and hung up in the chimney to dry. Those who take greater care, dry them in a stove, which is not so likely to injure the plumage as the foregoing method. Their beautiful feathers were once the ornament of the highest rank of savage nobility; but at present they take the bird rather for the purpose of selling it as a curiosity to the Europeans, than that of ornament for themselves. All the taste for savage finery is wearing out fast, even among the Americans. They now begin to adopt, if not the dresses of Europe, at least the materials of which they are composed. The wandering warrior is far from thinking himself fine at present with his bow and his feathered crown: his ambition reaches to higher ornaments; a gun, a blue shirt, and a blanket.

² This is a mistake. See note preceding page, and Supplementary note below.—Ed.

SUPPLEMENTARY NOTE.

The genus *Trochilus* comprises some of the smallest, but, at the same time, some of the most beautiful of the feathered tribe. Observers of every description have been struck with admiration at the elegance and variety of the tints which adorn them; but the extreme delicacy of their constitution generally unfits them for enduring the variable climates of the temperate zone, or the restraints of confinement. They have almost always died on the passage

homewards; and their admirers, in this country, are compelled to view only the preserved specimens in their cabinets, or such representations as we now offer. Those persons who have not seen them, numerous as butterflies, sporting in the sunny prairies of America, would hesitate at first to believe that birds of so minute a construction could exist. Yet we find the same perfection in the smallest as well as in the largest of Nature's works, and a structure prevails in these minute objects equally complicated with those of the ostrich and eagle.

It was long supposed, as they resemble the butterfly in fluttering from flower to flower, that they also partook of the same food, and subsisted on honey. It seems now to be clearly ascertained that they do not feed on honey, but on the insects which prey upon it. This might have readily been discovered upon comparing the structure of their bills, which are long, pointed, and altogether incapable of sucking up a fluid, or saccharine matter, with the *haustellum* or sucker, used by certain insects for that purpose. During their flight, they sometimes keep their bodies motionless in the air for hours together, emitting a loud humming noise, from which they derive their name. This sound is not emitted by the birds, but is occasioned solely by the exceedingly rapid vibration of their wings. They are generally confined to the tropical climates of America, although they have been found as far south as the Straits of Magellan, and as far north as the Elk river. They frequent the woods as well as prairies; and are often observed to enter the houses of the Americans in pursuit of insects, sometimes venturing to insert their delicate bills into a bouquet of flowers, and rapidly retreating on being approached.

We shall here enumerate and describe a few of the species of this beautiful bird.

The Tufted-necked humming-bird (*Trochilus ornatus*) derives its name from the singular tuft of feathers which surrounds the neck of the male, but of which the female is altogether deprived.

The Azure-blue humming-bird (*T. lazulus*) is distinguished by the brilliant hue of its breast.

The Harlequin humming-bird (*T. multicolor*) is so singular and fantastic in its colours, that the specimen in the British museum was long suspected to have been formed of feathers belonging to different species. This is now generally believed not to have been the case.

The Ruby-crested humming-bird (*T. moschitos*) is very common in the West Indies and in tropical America.

Gould's humming-bird (*T. Gouldii*) possesses one of those singular tufts round the neck, which the French term *coquets*, and have been not unaptly compared to the ruffs worn by ladies during the age of Queen Elizabeth.

The Gigantic humming-bird (*T. gigas*) is about the size of a thrush. This is the Patagonian of the humming-bird genus. In strength and size it is equalled by none.

The Least humming-birds (*T. minimus*) resemble the preceding only in the dulness of their colours, which are much inferior to their congeners. Yet we view these little creatures with singular interest, forming, as they do, one of the limits, in regard to size, of a numerous and interesting class of animated beings.

The White-striped humming-bird (*T. mesoleucus*) differs but slightly from the Evening humming-bird (*T. vesper*). Both these species have but a rudimentary tuft around the neck, which however is of a brilliant hue.

The Tri-coloured humming-bird (*T. tricolor*) appears to be surpassed in beauty by few of its tribe.

Rivoli's humming-bird (*T. Rivolii*) is a native of Mexico, and the specimen from which this draw-

ing was made is in the collection of the Duke of Rivoli, who possesses one of the finest private cabinets of birds in Europe. Nothing can exceed the splendid display of colours exhibited by its head and throat, the beryl and ruby vying with each other in splendour; and these are beautifully set off by the strong black which surrounds the more brilliant hues.

The Violet-crowned humming-bird (*T. Stephanoides*) inhabits Chili, and according to Lesson, sips the nectar of the scarlet Loranthus. It will probably be found hereafter, that this bird feeds upon the insects which prey upon the nectar, rather than upon the nectar itself. It penetrates to the North during winter.

Stokes' humming-bird (*T. Stokesii*) is surpassed by few humming-birds in beauty and elegance of form. The tuft of bright cobalt blue which decorates its crown, adds great beauty to the bird. It was discovered by Captain King on the island of Juan Fernandez.

The Northern humming-bird (*T. colubris*) is the humming-bird of the United States of America, and along with others lately described by Mr. Audubon, are the only species of this numerous tribe which migrate so far north. This species arrives in Louisiana about the 10th of March, but is seldom found in the middle districts before the 15th of April. A person standing in a garden by the side of a common Althæa in bloom, will be surprised to hear the humming of their wings, and then see the birds themselves within a few feet of him; he will be astonished at the rapidity with which the little creatures rise into the air, and are out of sight and hearing the next moment.

When morning dawns, and the blest sun again
Lifts his red glories from the eastern main,
Then through our woodbines, wet with glittering dews,
The flower-fed Humming-bird his rounds pursues;
Sips, with inserted tube, the honey'd blooms,
And chirps his gratitude, as round he roams:
While richest roses, though in crimson drest,
Shrink from the splendour of his gorgeous breast.
What heavenly tints in mingling radiance fly!
Each rapid movement gives a different dye;
Like scales of burnish'd gold they dazling show,
Now sink to shade—now like a furnace glow!

We are assured by Mr. Audubon, that this species at least principally lives upon insects, which it seeks out diligently in the nectarium of the flowers, where a great number of insects are always to be found, attracted by the honey. These it rapidly abstracts with its tongue.

The Crested humming-bird (*T. cristatus*) is a native of the islands of Martinique and Trinité. Its breast is emerald green with iridescent blue reflections. The female is devoid of a crest.

The Purple humming-bird (*T. caligena*) is a native of Mexico, where it was first discovered by M. F. Prévost. It ranks among the larger species; and although having no great variety of colours in its plumage, is, however, a very beautiful bird.

Wagler's humming-bird (*T. Wagleri*) is distinguished by the remarkable form of the crest from all others of its tribe; and its elegantly graduated tail gives it a very handsome aspect. It is a native of the warmer part of Brazil.

The Horned humming-bird (*T. cornutus*) is a native of the elevated Compos-Geraes of Brazil.

The Half-tailed humming-bird (*T. enicurus*) is remarkable on account of having only six quill feathers in its tail. It inhabits Brazil.

The Azure-crowned humming-bird (*T. cyanocephalus*), so named on account of the rich blue of the upper part of its head, is not remarkable for brilliancy of colour. It is a native of Brazil, but its peculiar history is unknown.

The Blue-fronted humming-bird (*T. glaucopsis*) is nearly four and a half inches long, with the top of

the head indigo-blue changing to green, the back of a deep gold-green, the wings brown, and the tail steel-blue. It inhabits Brazil.

Temminck's humming-bird (*T. Temminckii*), was first described by the celebrated ornithologist, to whom it has since been dedicated by M. Lesson, who states that it "belongs to Brazil, that rich country which yields the diamond, and nourishes the most beautiful birds."

The Sapphire and emerald humming-bird (*T. bicolor*) is nearly three and a half inches long, and distinguished by blue and emerald-green colours, and is said, by Buffon, to be a native of Guadeloupe; by Sonnini, to occur also in Martinique; and, by Lesson, to have been received from French Guiana.

Clemence's humming-bird (*T. Clemenciae*), about five inches in length, and of a bright green colour above, is a native of Mexico.

The Topaz-throated humming-bird (*T. pella*), although the most common species, is one of the most

splendidly coloured, being of a brilliant ruby tint, varying to dusky red, the head velvet black, the throat emerald green, changing to gold yellow. The male is distinguished, moreover, by two very long dusky feathers in the tail. This species is plentiful in Guiana, and the neighbourhood of Cayenne. The female wants the long tail-feathers, and is of a deep green colour, with the throat yellowish-red.

The Violet-eared humming-bird (*T. auritus*) is so named on account of two tufts of feathers on the sides of the head, of which one is of a violet purple colour, while the other is emerald green. The upper parts are of a gilded green tint, the lower pure white. The middle tail-feathers are bluish-black, the rest white. It is one of the most common species of Guiana and Brazil. The female resembles the male, but differs in wanting the green and purple tufts on the auricular region, and in having the white of the breast and abdomen mixed with numerous brown or dusky spots.

BOOK VII.

OF BIRDS OF THE CRANE KIND.

CHAP. I.

OF BIRDS OF THE CRANE KIND IN GENERAL.

THE progressions of Nature from one class of beings to another, are always by slow and almost imperceptible degrees. She has peopled the woods and the fields with a variety of the most beautiful birds; and, to leave no part of her extensive territories untenanted, she has stocked the waters with its feathered inhabitants also: she has taken the same care in providing for the wants of her animals in this element, as she has done with respect to those of the other; she has used as much precaution to render water-fowl fit for swimming, as she did in forming land-fowl for flight; she has defended their feathers with a natural oil, and united their toes by a webbed membrane: by which contrivances they have at once security and motion. But between the classes of land-birds that shun the water, and of water-fowl that are made for swimming and living on it, she has formed a very numerous tribe of birds, that seem to partake of a middle nature; that, with divided toes, seemingly fitted to live upon land, are at the same time furnished with appetites that chiefly attach them to the waters. These can properly be called neither land-birds nor water-fowl, as they provide all their sustenance from watery places, and yet are unqualified to seek it in those depths where it is often found in greatest plenty.

This class of birds, of the crane kind, are to be distinguished from others rather by their appetites than their conformation. Yet even in this

respect they seem to be sufficiently discriminated by nature: as they are to live among the waters, yet are incapable of swimming in them, most of them have long legs, fitted for wading in shallow waters, or long bills proper for groping in them.

Every bird of this kind, habituated to marshy places, may be known, if not by the length of its legs, at least by the scaly surface of them. Those who have observed the legs of a snipe or a woodcock, will easily perceive my meaning; and how different the surface of the skin that covers them is from that of the pigeon or the partridge. Most birds of this kind also, are bare of feathers half way up the thigh; at least, in all of them above the knee.—Their long habits of wading in the waters, and having their legs continually in moisture, prevents the growth of feathers on those parts; so that there is a surprising difference between the legs of a crane, naked of feathers almost up to the body, and the falcon, booted almost to the very toes.

The bill is also very distinguishable in most of this class. It is, in general, longer than that of other birds, and in some finely fluted on every side; while at the point it is possessed of extreme sensibility, and furnished with nerves, for the better feeling their food at the bottom of marshes, where it cannot be seen. Some birds of this class are thus fitted with every convenience; they have long legs for wading, long necks for stooping, long bills for searching, and nervous points for feeling. Others are not so amply provided for; as some have long bills, but legs of no great length; and others have long necks,

but very short legs. It is a rule which universally holds, that where the bird's legs are long, the neck is also long in proportion. It would indeed be an incurable defect in the bird's conformation, to be lifted upon stilts above its food, without being furnished with an instrument to reach it.

If we consider the natural power of this class, in a comparative view, they will seem rather inferior to those of every other tribe. Their nests are more simple than those of the sparrow, and their methods of obtaining food less ingenious than those of the falcon; the pie exceeds them in cunning; and though they have all the voraciousness of the poultry tribe, they want their fecundity. None of this kind, therefore, have been taken into man's society, or under his protection; they are neither caged, like the nightingale; nor kept tame, like the turkey; but lead a life of precarious liberty, in fens and marshes, at the edges of lakes, and along the sea-shore. They all live upon fish or insects, one or two only excepted; even those that are called *mud-nickers*, such as the snipe and the woodcock, it is probable, grope the bottom of marshy places only for such insects as are deposited there by their kind, and live in a vermicular state, in pools and plashe, till they take wing, and become flying insects.

All this class, therefore, that are fed upon insects, their food being easily digestible, are good to be eaten; while those who live entirely upon fish, abounding in oil, acquire in their flesh the rancidity of their diet, and are, in general, unfit for our tables. To savages, indeed, and sailors on a long voyage, everything that has life seems good to be eaten; and we often find them recommending those animals as dainties, which they themselves would spurn at after a course of good living. Nothing is more common in their journals than such accounts as these:—"This day we shot a fox—pretty good eating: this day we shot a heron—pretty good eating: and this day we killed a turtle"—which they rank with the heron and the fox, as "pretty good eating." Their accounts, therefore, of the flesh of these birds are not to be depended upon; and when they cry up the heron or the stork of other countries as luxurious food, we must always attend to the state of their appetites who give the character.

In treating of this class of birds, it will be best to observe the simplest method possible; neither to load the memory with numerous distinctions, nor yet confuse the imagination by a total want of arrangement. I will, therefore, describe some of the larger sorts separately; as, in a history of birds, each of these demands peculiar distinction. The crane, the stork, the Balearic crane, the heron, the bittern, with some others, may require a separate history. Some particular tribes may next offer, that may very naturally be classed together; and as for all the smaller and

least remarkable sorts, they may be grouped into one general description.

CHAP. II.

THE CRANE.

THERE is something extraordinary in the different accounts we have of this bird's size and dimensions. Willoughby and Pennant make the crane from five to six feet long, from the tip to the tail. Other accounts say that it is above five feet high; and others, that it is as tall as a man. From the many which I myself had seen, I own this imputed magnitude surprised me; as from memory I was convinced they could neither be so long nor so tall. Indeed, a bird, the body of which is not larger than that of a turkey-hen, and acknowledged on all hands not to weigh above ten pounds, cannot easily be supposed to be almost as long as an ostrich. Brisson, however, seems to give this bird its real dimensions, when he describes it as something less than the brown stork, about three feet high, and about four from the tip to the tail. Still, however, the numerous testimonies of its superior size are not to be wholly rejected; and, perhaps, that from which Brisson took his dimensions was one of the smallest of the kind.

The crane, taking its dimensions from him, is exactly three feet four inches from the tip to the tail, and four feet from the head to the toe. It is a tall slender bird, with a long neck and long legs. The top of the head is covered with black bristles, and the back of it is bald and red, which sufficiently distinguishes this bird from the stork, to which it is very nearly allied in size and figure. The plumage, in general, is ash-coloured; and there are two large tufts of feathers, that spring from the pinion of each wing. These bear a resemblance to hair, and are finely curled at the ends, which the bird has the power of erecting and depressing at pleasure. Gesner says, that these feathers, in his time, used to be set in gold, and worn as ornaments in caps.

Such are the dimensions of a bird, concerning which, not to mention modern times, there have been more fables propagated than of any other. It is a bird with which all the ancient writers are familiar; and, in describing it, they have not failed to mix imagination with history. From the policy of the cranes, they say, we are to look for an idea of the most perfect republic amongst ourselves; from their tenderness to their decrepit parents, which they take care to nourish, to cherish, and support when flying, we are to learn lessons of filial piety; but particularly from their conduct in fighting with the pigmies of Ethiopia, we are to receive our maxims in the art of war. In early times, the history of Nature fell to the lot of poets only, and

certainly none could describe it so well; but it is a part of their province to embellish also; and when this agreeable science was claimed by a more sober class of people, they were obliged to take the accounts of things as they found them; and, in the present instance, fable ran down blended with truth to posterity.

In these accounts, therefore, there is some foundation of truth; yet much more has been added by fancy. The crane is certainly a very social bird, and they are seldom seen alone. Their usual method of flying or sitting is in flocks of fifty or sixty together; and while a part feed, the rest stand like sentinels upon duty. The fable of their supporting their aged parents, may have arisen from their strict connubial affection; and as for their fighting with the pigmies, it may not be improbable but that they have boldly withstood the invasions of monkeys coming to rob their nests; for in this case, as the crane lives upon vegetables, it is not probable that it would be the first aggressor.

However this be, the crane is a wandering, sociable bird, that, for the most part, subsists upon vegetables; and is known in every country of Europe except our own. There is no part of the world, says Bellonius, where the fields are cultivated, that the crane does not come in with the husbandman for a share in the harvest. As they are birds of passage, they are seen to depart and return regularly at those seasons when their provision invites or repels them. They generally leave Europe about the latter end of autumn, and return in the beginning of summer. In the inland parts of the continent, they are seen crossing the country in flocks of fifty or a hundred, making from the northern regions towards the south. In these migrations, however, they are not so resolutely bent upon going forward, but that if a field of corn offers in their way, they will stop awhile to regale upon it: on such occasions they do incredible damage, chiefly in the night; and the husbandman, who lies down in joyful expectation, rises in the morning to see his fields laid entirely waste by an enemy, whose march is too swift for his vengeance to overtake.

Our own country is free from their visits; not but that they were formerly known in this island, and held in great estimation for the delicacy of their flesh; there was even a penalty upon such as destroyed their eggs; but at present they never go so far out of their way.¹ Cultivation and populousness go hand in hand; and though our fields may offer them a greater plenty, yet it is so guarded that the birds find the venture greater than the enjoyment; and probably we are much better off by their absence than their company. Whatever their flesh might once have been, when, as Plutarch tells us, cranes were

blinded and kept in coops, to be fattened for the tables of the great in Rome; or, as they were brought up, stuffed with mint and rue, to the tables of our nobles at home; at present they are considered all over Europe as wretched eating. The flesh is fibrous and dry, requiring much preparation to make it palatable; and even after every art, it is fit only for the stomachs of strong and labouring people.

The cold arctic region seems to be this bird's favourite abode. They come down in the more southern parts of Europe, rather as visitants than inhabitants: yet it is not well known in what manner they portion out their time, to the different parts of the world. The migrations of the fieldfare or thrush are obvious and well known; they go northward or southward in one simple track; when their food fails them here, they have but one region to go to. But it is otherwise with the crane; he changes place like a wanderer: he spends the autumn in Europe; he then flies off, probably to some more southern climate, to enjoy a part of the winter; returns to Europe in the spring; crosses up to the north in summer; visits those lakes that are never dry; and then comes down again, to make depredations upon our cultivated grounds in autumn. Thus Gesner assures us, that the cranes usually begin to quit Germany from about the eleventh of September to the seventeenth of October; from thence they are seen flying southward by thousands; and Redi tells us, they arrive in Tuscany a short time after. There they tear up the fields, newly sown, for the grain just committed to the ground, and do great mischief. It is to be supposed, that, in the severity of winter, they go southward, still nearer the line. They again appear in the fields of Pisa, regularly about the twentieth of February, to anticipate the spring.

In these journeys, it is amazing to conceive the heights to which they ascend when they fly. Their note is the loudest of all other birds; and that is often heard in the clouds, when the bird is entirely unseen. As it is light for its size, and spreads a large expanse of wing, it is capable of floating at the greatest height, where the air is lightest; and as it secures its safety, and is entirely out of the reach of man, it flies in tracts which would be too fatiguing for any other birds to move forward in.²

² Cranes fly high, and arrange themselves in the form of a triangle, the better to cleave the air. When the wind freshens, and threatens to break their ranks, they collect their force into a circle, and adopt the same arrangement when the eagle attacks them. They always fly during the night, on which occasions the leader frequently calls, in order to rally his forces, and point out the track; and the cry is repeated by the flock, each answering to give notice that it follows and keeps its rank.

Part loosely wing the region: part more wise,
In common rang'd in figure, wedge their way,
Intelligent of seasons; and set forth
Their airy caravan, high over seas

¹ They are still, though very rarely, to be seen in this country.—ED.

In these aerial journeys, though unseen themselves, they have the distinctest vision of every object below. They govern and direct their flight by their cries; and exhort each other to proceed or to descend, when a fit opportunity offers for depredation. Their voice, as was observed, is the loudest of all the feathered tribe; and its peculiar clangour arises from the very extraordinary length and contortion of the windpipe. In quadrupeds, the windpipe is short, and the glottis, or cartilages that form the voice, are at that end of it which is next the mouth; in water-fowl, the windpipe is longer, but the cartilages that form the voice are at the other end, which lies down in their belly. By this means they have much louder voices, in proportion to their size, than any other animal whatever; for the note, when formed below, is reverberated through all the rings of the windpipe, till it reaches the air. But the voice of the duck or the goose is nothing to be compared to that of the crane, whose windpipe is not only made in the same manner with theirs, but is above twenty times as long. Nature seems to have bestowed much pains in lengthening out this organ. From the outside, it enters through the flesh into the breast-bone, which hath a great cavity within to receive it. There being thrice reflected, it goes out again at the same hole, and so turns down to the lungs, and thus enters the body a second time. The loud clangorous sound which the bird is thus enabled to produce, is, when near, almost deafening: however, it is particularly serviceable to the animal itself, either during its migrations or its stay; by it the flock is encouraged in their journeys; and if, while they are feeding, which is usually performed in profound silence, they are invaded on any side, the bird that first perceives the danger is sure to sound the alarm, and all are speedily upon the wing.

As they rise but heavily, they are very shy birds, and seldom let the fowler approach them. Their depredations are usually made in the darkest nights; at which time they enter a field of corn, and trample it down, as if it had been crossed over by a regiment of soldiers. On other occasions, they choose some extensive solitary marsh, where they range themselves all day, as if they were in deliberation; and not having that grain which is most to their appetites, wade the marshes for insects and other food, which they can procure with less danger.

Corn is their favourite food; but there is scarcely any other that comes amiss to them. Redi, who opened several, found the stomach of one full of the herb called dandelion; that of another was filled with beans; a third had a great quantity of clover in its stomach; while that of two others was filled with earth-worms and bee-

bles; in some he found lizards and sea-fish; in others, snails, grass, and pebbles, swallowed perhaps for medicinal purposes. It seems, therefore, that these birds are easily supplied; and that they are noxious to corn-fields but on some particular occasions.³

In general it is a peaceful bird, both in its own society and with respect to those of the forest. Though so large in appearance, a little falcon pursues, and often disables it. The method is, with those who are fond of hawking, to fly several hawks together against it; which the crane endeavours to avoid, by flying up perpendicularly, till the air becomes too thin to support it any higher. The hawk, however, still bears it company; and though less fitted for floating in so thin a medium, yet, possessed of greater rapidity, it still gains the ascendancy. They both often rise out of sight; but soon the spectator, who keeps his eye fixed above, perceives them like two specks, beginning to appear: they gather on his eye for a little space, and shortly after come tumbling perpendicularly together, with great animosity on the side of the hawk, and a loud screaming on that of the crane. Thus driven to extremity, and unable to fly, the poor animal throws itself upon its back, and, in that situation, makes a most desperate defence, till the sportsman coming up, generally puts an end to the contest with its life.

It was once the barbarous custom to breed up cranes to be thus baited; and young ones were taken from the nest to be trained up for this cruel diversion. It is an animal easily tamed; and, if we can believe Albertus Magnus, has a particular affection for man. This quality, however, was not sufficient to guard it from being made the victim of his fierce amusements. The female, which is easily distinguished from the male, by not being bald behind as he is, never lays above two eggs at a time; being like those of a goose, but of a bluish colour. The young ones are soon fit to fly, and then the parents forsake them to shift for themselves; but, before this time, they are led forth to the places where their food is most easily found. Though yet unfledged, they run with such swiftness that a man cannot easily overtake them. We are told, that as they grow old, their plumage becomes darker; and, as a proof of their longevity, Aldrovandus assures us, that a friend of his kept one tame for above forty years.

Whatever may have been the disposition of the great, the vulgar of every country, to this day, bear the crane a compassionate regard. It is possible the ancient prejudices in its favour, which once having been planted, are eradicated but slowly, may still continue to operate. In some countries, it is considered as a heinous offence to kill a crane; and though the legisla-

Flying, and over lands with mutual wing,
Easing their flight,—so steers the prudent crane,
Her annual voyage, borne on winds: the air
Floats as they pass, fan'd with unnumber'd plumes.—Ed.

³ The aliment of cranes is more vegetable than that of storks, herons, &c.—Ed.

ture declines to punish, yet the people do not fail to resent the injury. The crane, they, in some measure, consider as the prophet of the season: upon its approach or delay they regulate the periods of their rural economy. If their favourite bird comes early in the season, they expect a plentiful summer; if he is slow in his visits, they then prepare for an unfavourable spring. Whatever wisdom there may be in despising the prejudices of the vulgar, there is but little in condemning them. They have generally had their origin in good motives; and it should never be our endeavours to suppress any tender emotions of friendship or pity in those hard breasts that are, in general, unsusceptible of either.

SUPPLEMENTARY NOTE.

Busbequius tells us of a Spaniard who was so beloved by a crane of Majorca, that the poor bird would walk anywhere with him, and in his absence seek about for him, make a noise that he might hear her, and knock at his door; and when he took his last farewell, not able to sustain her loss and passionate desire, she abstained from all food and died.—In the menagerie of the Jardin des Plantes, at Paris, was a crane, which Mons. Valentin had brought from Senegal. The bird was attended by that merchant, during the voyage, with the most assiduous care; but upon landing in France, it was sold, or given to the Museum of Natural History. Several months after its introduction, Valentin arriving at Paris, went to the menagerie, and walked up to the cage in which the bird was confined. The crane instantly recognised him; and when Valentin went into its cage, it lavished upon him every mark of affectionate attachment.—A gentleman residing in England, had for some years been possessed of two brown cranes; one of them at length died, and the survivor became disconsolate. He was apparently following his companion, when his master introduced a large mirror into the aviary. The bird no sooner beheld his reflected image, than he fancied she for whom he mourned had returned to him; he placed himself close to the mirror, plumed his feathers, and showed every sign of happiness. The scheme answered completely, the crane recovered his health and spirits, passed almost all his time before the looking-glass, and lived many years after, at length dying from an accidental injury.

CHAP. III.

THE STORK.

If we regard the stork externally only, we shall be very apt to confound it with the crane. It is of the same size; it has the same formation as to the bill, neck, legs, and body, except that it is something more corpulent. Its differences are but very slight; such as the colour, which in the crane is ash and black, but in the stork is white and brown. The nails of the toes of the stork also are very peculiar; not being clawed like those of other birds, but flat like the nails of a man.

These, however, are but very slight differences; and its true distinctions are to be taken rather from its manners than its form. The crane has a loud piercing voice; the stork is silent, and produces no other noise than the clacking of its under chap against the upper: the crane has a strange convolution of the wind-pipe through the breast-bone; the stork's is formed in the usual manner; the crane feeds mostly upon vegetables and grain; the stork preys entirely upon frogs, fishes, birds, and serpents: the crane avoids towns and populous places; the stork lives always in or near them: the crane lays but two eggs, and the stork generally four. These are distinctions fully sufficient to mark the species, notwithstanding the similitude of their form.

Storks are birds of passage, like the former; but it is hard to say whence they come or whither they go. When they withdraw from Europe, they all assemble on a particular day, and never leave one of their company behind them. They take their flight in the night; which is the reason the way they go has never been observed. They generally return into Europe in the middle of March, and make their nests on the tops of chimneys and houses as well as of high trees. The females lay from two to four eggs, of the size and colour of those of geese; and the male and female sit upon them by turns. They are a month in hatching; and when their young are excluded, they are particularly solicitous for their safety.

As the food of these birds consists in a great measure of frogs and serpents, it is not to be wondered at that different nations have paid them a particular veneration. The Dutch are very solicitous for the preservation of the stork in every part of their republic. This bird seems to have taken refuge among their towns; and builds on the tops of their houses without any molestation. There it is seen resting familiarly in their streets, and protected as well by the laws as the prejudices of the people. They have even got an opinion that it will only live in a republic; and that story of its filial piety, first falsely propagated of the crane, has in part been ascribed to the stork. But it is not in republics alone that the stork is seen to reside, as there are few towns on the continent, in low marshy situations, but have the stork as an inmate among them; as well the despotic princes of Germany as the little republics of Italy.¹

The stork seems a general favourite even among the moderns; but with the ancient Egyptians their regard was carried even to adoration. This enlightened people, who worshipped the Deity in his creatures, paid divine honours to the ibis, as is universally known. It has been usually supposed that the ancient ibis is the same with that which goes at present by the same name; a bird of the stork kind, of about the size of a curlew, all over black, with a bill

¹ See Supplementary Note A, p. 169.

very thick in the beginning, but ending in a point, for the better seizing its prey, which is caterpillars, locusts, and serpents. But, however useful the modern ibis may be in ridding Egypt, where it resides, of the vermin and venomous animals that infest it; yet it is much doubted whether this be the same ibis to which the ancients paid their adoration. Maillet, the French consul at Cairo, observes, that it is very hard to determine what bird the ancient ibis certainly was, because there are cranes, storks, hawks, kites, and falcons, that are all equal enemies to serpents, and devour a vast number. He farther adds, that in the months of May, when the winds begin to blow from the internal parts of Africa, there are several sorts of birds that come down from Upper Egypt, from whence they are driven by the rains, in search of a better habitation, and that it is then they do this country such signal services. Nor does the figure of this bird hieroglyphically represented on their pillars mark it sufficiently to make the distinction. Besides, the modern ibis is not peculiar to Egypt, as it is to be seen but at certain seasons of the year; whereas we are informed by Pliny, that this bird was seen nowhere else. It is thought, therefore, that the true ibis is a bird of the vulture kind, described above, and called by some the capon of Pharaoh, which not only is a devourer of serpents, but will follow the caravans that go to Mecca, to feed upon the offal of the animals that are killed on the journey.²

² See Supplementary Note B, p. 171.

NOTE A.—*The Storks.*

In the methodical arrangements of Ray and Brisson the storks formed a distinct genus from the herons and the cranes, with which, and with various other less closely allied groups, they were united in the Linnaean system of classification. Later naturalists have, however, seen the necessity of reverting to the older method, and of again separating these groups, which form in the arrangement proposed by Mr. Vigors two families, distinguished by well marked characters, and each comprehending several genera of considerable numerical extent. The first of these families is the *Gruidæ*, which comprise the cranes, the trumpeter, and other nearly related genera, distinguished by the comparative shortness and obtuseness of their bill, and the slight degree of palmation exhibited by their feet, which are smaller in proportion and consequently better adapted to the terrestrial habits of these birds, as the bill is to their vegetable food. The second is the *Ardeidæ*, whose produced and generally pointed bill, and long, slender, and more deeply webbed toes, are equally well suited to their aquatic habits, and to the nature of the food, chiefly fishes and reptiles, on which they subsist. In the latter family are comprehended not only the storks and the herons, but also the spoon-bills, the ibis, and several other groups remarkable as well for the singularity of their forms, as for the peculiarity of their manners, and the interesting nature of many of the facts connected with their history, both as regards themselves and with reference to the services which they actually render, or have been supposed to render, to mankind.

The distinguishing characters of the genus which at present engages our attention consists in a long straight beak, broad at the base, regularly narrowing to the point, opening to a moderate extent, and unimpressed on its upper surface either with lateral furrows or with a nasal pit; nostrils in the form of a longitudinal fissure, situated near the base of the bill and directed upwards; tongue extremely short; eyes surrounded by a naked skin; wings broad, expanding to a great extent, and prolonged posteriorly beyond the extremity of the tail; legs reticulated with hexagonal scales, of which the uppermost are the largest; web between the two outer of the anterior toes much more developed than that which is found at the base of the inner; posterior toe on the same level with the anterior ones; and claws broad, flat, and obtuse, approaching in form to the nails of man, and scarcely overlapping the extremities of the toes.

The species thus characterized are especially remarkable for the extent and regularity of their migrations, which are chiefly determined by the nature of their food. This consists of various kinds of garbage, of worms and insects, fishes and reptiles, and among the latter more particularly of frogs. At the approach of the colder season, when these animals begin to conceal themselves in holes, in order to pass the winter in a state of torpor, the storks are driven by the failure of their usual means of subsistence to seek a more temperate climate, in which the same scarcity of food is not likely to be felt; but they constantly return northwards with the return of spring. The most common and the most celebrated among them is the White stork, which generally passes its winters in the north of Africa, and more particularly in Egypt, and migrates during the summer season to France and Holland, Sweden, Germany, Poland, and sometimes even Russia, but is very rarely met with in England. It is rather larger than the Black stork, measuring more than three feet from the extremity of the bill to the tip of the tail, and standing about the same height from the ground to the top of its head. Its bill, which is usually of an orange red, measures from seven to eight inches in length; the naked and wrinkled skin surrounding its eyes is nearly of the same colour, but generally of a duskier hue; and its legs are also red. The greater part of its plumage is of a clear white, which is however relieved by the striking contrast of the feathers covering the lower part of the shoulders, the larger wing-coverts, and the quill-feathers, thirty in number, all of which are of a glossy black, with a slight metallic reflection. When fully expanded the extent of the wings exceeds six feet, and in this state the eight or nine primary quill-feathers offer a very singular and indeed unique disposition, being separated from each other so as to leave a vacant space between. The feathers of the lower part of the neck are long, pendulous, and pointed. There is little distinction in any of these particulars between the male and the female; but the young have a browner tinge in their wings, and their bills are of a duskier red.

The general disposition of the stork is mild and placid. It is an animal easily tamed; and may be trained to reside in gardens, which it will clear of insects and reptiles. It has a grave air, and a mournful visage; yet, when roused by example, it shows a certain degree of gayety, for it joins in the frolics of children, hopping about and playing with them: "I saw in a garden," says Dr. Hermann, "where the children were playing at hide and seek, a tame stork join the party, run its turn when touched; and distinguish the child whose turn it was to pursue the rest, so well, as, along with the others, to be on its guard." The following lines well describe the ordinary habits of this bird before migration.

"Where the Rhine loses its majestic force
In Belgian plains,—won from the raging deep

By diligence amazing, and the strong
Unconquerable hand of Liberty.—
The stork assembly meets; for many a day,
Consulting deep and various, ere they take
Their arduous voyage through the liquid sky.
And now their route design'd, their leaders chose,
Their tribes adjusted, clean'd their vigorous wing;
And many a circle, many a short essay,
Wheel'd round and round, in congregations full
The figur'd flight ascends; and, riding high
The aerial billows, mixes with the clouds."

At Smyrna, storks have become very familiar, and build their nests on the tops of houses, and other elevated situations. The inhabitants take particular delight in amusing themselves at the expense of the life of the poor hen birds. This is by taking away some of the stork's eggs from their nests, and replacing them by those of the common domestic fowl. When the young are hatched, the sagacious male bird discovers the difference of these from their own brood, and set up a hideous screaming, which excites the attention of the neighbouring storks, which fly to his nest. Seeing the cause of their neighbour's uneasiness, they simultaneously commence pecking the hen, and soon deprive her of life, supposing these spurious young ones to be the produce of her conjugal infidelity. The male bird in the meantime appears melancholy, and bemoans her loss, though he seems to conceive she justly merited her fate, for bringing disgrace upon her family.

These birds have in all ages been regarded with peculiar favour, amounting, in some countries, almost to veneration, partly on account of the services which they perform in the destruction of noxious animals, and in removing impurities from the surface of the earth, and partly on account of the mildness of their temper, the harmlessness of their habits, and the moral virtues with which imagination has delighted to invest them. Among the ancient Egyptians the stork was regarded with a reverence inferior only to that which, for similar causes, was paid to the sacred ibis, considered, and with some show of reason, as one of the tutelary divinities of the land. The same feeling is still prevalent in many parts of Africa and the East; and even in Switzerland and in Holland something like superstition seems to mingle, in the minds of the common people, with the hospitable kindness which a strong conviction of its utility disposes them to evince towards this favourite bird. In the latter country more particularly, the protection which is accorded to it is no more than it fairly deserves as the unconscious instrument by which the dikes and marshes are relieved from a large portion of the enormous quantity of reptiles engendered by the humidity and fertility of the soil.

On the other hand, the white stork appears to be influenced by the same friendly feelings towards man. Undismayed by his presence, it builds its nest upon the house-top, or on the summits of the loftiest trees in the immediate neighbourhood of the most frequented places. It stalks perfectly at its ease along the busy streets of the most crowded town, and seeks its food on the banks of rivers or in fens in close vicinity to his abode. In numerous parts of Holland its nest, built on the chimney top, remains undisturbed for many succeeding years, and the owners constantly return with unerring sagacity to the well known spot. The joy which they manifest on again taking possession of their deserted dwelling, and the attachment which they testify towards their benevolent hosts, are familiar in the mouths of every one. Their affection for their young is one of the most remarkable traits in their character. It is almost superfluous to repeat the history of the female which, at the conflagration of Delft, after repeated and unsuccessful attempts to carry off her young, chose rather to perish with them in the general ruin than to leave them to their fate: and there are many other and well authenticated proofs of a similar dis-

position. They generally lay from two to four eggs, of a dingy yellowish white, rather longer than those of the goose, but not so broad. The incubation lasts for a month, the male sharing in the task during the absence of the female in search of food. When the young birds are hatched, they are carefully fed by their parents, who watch over them with the closest anxiety. As soon as they become capable of flying, the parents exercise them in it by degrees, carrying them at first upon their own wings, and then conducting them in short circular flights around their nest.

When in search of food, the stork is commonly seen in its usual attitude of repose, standing upon one leg, with its long neck bent backwards, its head resting on its shoulder, and its eye steadily fixed. Its motions are slow and measured, the length of its steps corresponding with that of its legs. In flight its head and neck are directed straight forwards, and its legs extended backwards; an awkward and apparently constrained position, but that which is best calculated for enabling it to cleave the air with rapidity. The large extent of its wings and the comparative lightness of its body are also admirably adapted to the lofty pitch at which it flies, and to its long continuance upon the wing.

From the following remarkable fact, it seems evident that storks are capable of communicating their ideas to each other. A tame stork had taken up his abode for some years in the college-yard at Zabingen. Upon a neighbouring house was a nest, in which the storks that annually resorted to the place used to hatch their eggs. One day in autumn, a young collegian fired a shot at this nest. Probably the stork that was sitting on the nest was wounded by the shot, for after that time he did not fly out of it for several weeks. However, at the usual time, he took his departure with the rest of the storks. In the ensuing spring, a stork appeared upon the roof of the college, who by clapping his wings, seemed to invite the tame stork to come to him. The latter, however, could not accept the invitation, as his wings were clipped. After some days, the wild stork came down himself into the yard. The tame one went to meet him, clapping his wings as if to bid him welcome, but was immediately attacked by the other with great fury. The persons present protected him indeed; but the wild stork often afterwards repeated his attempts upon him; and incommoded him throughout the whole of the summer. The next spring, instead of a single stork, four of them came at once into the yard, and attacked the tame one. As he was unable of himself to contend with such a number of adversaries, the cocks, hens, geese, ducks, in short all the poultry in the yard came to his assistance, and rescued him from his enemies. The people of the house now paid greater attention than before to this stork, and prevented his being further molested during that year. But in the beginning of the third spring, upwards of twenty storks rushed at once into the yard with the utmost fury, and killed the tame stork before either man or beast could afford him assistance. Thus the animosity of these twenty storks seemed to originate from that of the four which had made their appearance the preceding year, and they seemed to have been instigated by the one that first attacked the tame stork. It cannot indeed be positively asserted, that it was the wounded stork that made the first attack upon the tame one in the ensuing year, but so much at least appears certain, that the enemies who attacked him in three successive years, must have communicated their hostile designs to each other. The above is not the only instance of storks resenting injuries, as will be seen by the following anecdote, which is much of a piece with the foregoing. A farmer near Hamburg, having caught a wild stork,

brought it to his farm-yard, where he had a tame one, to which he expected it would form an excellent companion, but the tame one being jealous of a rival, fell upon the wild one, and beat him so unmercifully, that he was compelled to evacuate the premises. About four months afterwards, however, he returned to the poultry-yard, accompanied by three other storks, who alighted and commenced a furious attack upon the tame stork, and killed him.

The storks generally migrate about the beginning of August, and the preparations for their departure usually occupy several weeks. They appear gradually to assemble in one spot from the whole of the surrounding district to the number of many hundreds, making when they meet that peculiar clattering with their beaks, which appears to serve them in the place of voice. As soon as their number is completed the entire body mount at once into the air, without noise or confusion, and are speedily lost sight of in the loftiness of their flight. Their departure has rarely been witnessed by scientific observers; and many incredible stories have consequently been told respecting it. They return to Europe in smaller bands in the months of March and April. Those which remain in the more northern countries during the winter, either tamed or in captivity, in which state they appear perfectly contented, do not seem to suffer in the least from the severity of the weather.

The *Black stork* resembles the White in form and proportions, but is somewhat smaller in size; and the hue of its plumage, as might be gathered from the epithets applied to the two birds, is very different. But these epithets, if taken strictly, are far from being correct: the White stork having, as we have seen, a portion of its plumage black; and the Black exhibiting a variety of shades, of which, however, that from which it derives its name is the most predominant. Its bill, like that of the former bird, is full seven inches in length, and of a dusky red, approaching to orange; as are also the legs and toes.

The colour of the naked skin surrounding the eyes is dull red, and that of the irides hazel. On the head, neck, upper surface of the body and wings, the feathers are of a deep glossy black, intermingled with varying shades and reflexions of violet and green, which become more strongly marked on the back and wings. Those of the whole under surface from the bottom of the neck to the base of the tail are white. The tail itself is black. The wings are extremely long, and so powerful as to raise the bird in its flights and migrations, to such a height in the air as to be almost invisible to human eye. Like the foregoing species, the black stork is a migratory bird, seeking the more southern parts of Europe during the inclemency of winter. In the spring it advances to a much higher latitude than the white, visiting even Russia and Siberia, and passing over Sweden towards the north in considerable numbers. But it seldom comes so far westward as the other, being almost unknown in Holland, although common in the eastern departments of France and throughout the whole of Germany. A solitary instance of its occurrence in Great Britain fell under the notice of the late Colonel Montagu, and forms the subject of an interesting paper in the twelfth volume of the *Linnean Transactions*.

The character of the black stork is in one respect diametrically opposed to that of the white. Instead of domesticating itself as it were with man, it shuns his society, and makes its temporary dwelling in the most secluded spots, frequenting impenetrable morasses or the banks of such rivers and lakes as are seldom disturbed by the presence of intruders, and building its nest on the summits of the loftiest pines. Its food is exactly similar to that of its more social fellow; and their manners, except in this peculiar sullenness on the part of the black stork, closely

correspond. It submits itself with perfect resignation to captivity, never using its powerful bill as a weapon of offence against its companions. It appears to have no other voice than the clattering sound which it produces by the snapping of its mandibles."—*Zoological Society Gardens*.

NOTE B.—*The Ibis*.

That a bird so highly celebrated in mythological history as the ibis of ancient Egypt, incessantly represented on the early monuments of the country which it still inhabits, and transmitted to us in almost infinite numbers in the shape of mummies from a remote antiquity, should have been widely mistaken by every modern writer until within the last fifty years, is indeed matter of astonishment; but such is really the fact. Belon, an excellent ornithologist, who visited Egypt about the middle of the sixteenth century, imagined that the stork was the true ibis of the ancients: Pocock maintained that the latter was a species of crane: and De Maillet conjectured that under the name of ibis were generically comprehended all those birds which are instrumental in removing the noxious reptiles that swarm in the inundated lands. Perrault first introduced the erroneous notion that the ibis of antiquity was a species of *Tantalus*, in which he was followed implicitly by naturalists throughout the whole of the last century. Brisson, Buffon, Linnaeus, and Latham, all united to give it currency; and the *Tantalus ibis* of the two latter authors was universally regarded as the sacred bird. Our adventurous countryman Bruce was the first to throw a doubt upon the authenticity of this determination, and to point out the identity between the figures represented on the ancient monuments, the mummies preserved in the Egyptian tombs, and a living bird common on the banks of the Nile and known to the Arabs by the name of *Abou Hannes*. But it was not until after the return of the French expedition from Egypt that the question was definitively settled by a careful anatomical comparison of the ancient mummies and recent specimens then brought home by Geoffroy-Saint-Hilaire and Savigny. From the examination of these materials M. Cuvier was enabled to verify Bruce's assertion, and to restore to science a bird which, after having formed for centuries the object of a nation's adoration, had fallen into oblivion, and was wholly unknown to modern naturalists. At the same time he pointed out those distinctive characters on which M. Lacepede founded the genus *ibis*, formally established by M. Cuvier himself in the first edition of his *Regne Animal*.

The ibis genus is characterized by a long and slender bill, nearly square at its base, where it is of less breadth than the head, almost straight for about one half of its length, and having the remaining part gradually curved downwards, blunt at its point and without any notch; nostrils situated near the base of the bill at the commencement of a groove which is continued along each side of its upper surface as far as to its point; the head, and sometimes the neck, devoid of feathers to an extent varying in the different races; wings of moderate length; tarsi slender; and toes webbed at the base, the hinder one placed somewhat above the level of the others but being of sufficient length to rest upon the earth. In many of these characters we observe a considerable deviation from those of the storks and other typical examples of the family with which the ibis is associated, and a marked approach to the curlews. From the natural habits and organization of the ibis, confirmed by analogy, and further corroborated by the testimony of the modern Egyptians, it does not appear that it feeds upon reptiles. We must, then, look for other reasons than the destruction of serpents, for the veneration paid to the ibis by the ancient Egyptians, who

admitted it even into their temples, and prohibited the killing of it under pain of death. In a country, where the people, very ignorant, were governed only by superstitious ideas, it was natural that fictions should have been imagined, to express with energy the happy influences of that phenomenon which every year attracts the ibis into Egypt, and retains it there. Its constant presence at the epoch of that inundation, which annually triumphs over all the sources of decay, and assures the fertility of the soil, must have appeared to the priests and the persons at the head of government admirably calculated to make a lively impression on the minds of the people, to lead them to suppose supernatural and secret relations between the movements of the Nile and the sojourn of these inoffensive birds, and to consider the latter as the cause of effects exclusively owing to the overflow of the river.

Besides the white and black ibis, another ibis, entirely black, was equally revered in Egypt, and embalmed in a similar manner. This one is more elegant and slender than the other in its external form, and its internal organs are also more contracted. M. Savigny has opened about twenty individuals of this species, and has found nothing in their very narrow gizzard, but small fluviatile shells, with some debris of vegetables, which probably enveloped the shells at the moment in which they were swallowed, and cannot be considered as properly constituting any part of the aliment of these birds.

The two species have a powerful and elevated flight. In this action the neck and feet are extended horizontally, and from time to time the birds altogether set forth deep and hoarse cries, more powerful in the white ibis than in the black. When these birds alight on lands which they have newly discovered, they remain crowded against each other, and may be seen for entire hours, occupied in searching the mud with their bills, advancing slowly, step by step, and never springing with rapidity like the curlews. The ibis does not nestle in Egypt. Those of the white kind arrive as soon as the Nile begins to increase, and their number augments or diminishes, as do its waters. Their migration takes place towards the end of June, the epocha at which, according to Bruce, they arrive in Ethiopia. The black ibis, which comes later into Egypt, also remains there longer. The moment when the ibides retire with the waters of the Nile, is the time in which the hunters prefer to pursue them. They seldom shoot them with fire-arms, but lay nets for them; and during autumn, many, whose heads have been previously severed from their bodies, are found in the markets of Lower Egypt, especially in that of Damietta. Many of the ibides, both black and white, were brought alive to M. Savigny, who observed that they most frequently held their bodies nearly horizontal, with the neck inflected, and the head inclined—were in the habit of striking the earth with the end of their bill, and sometimes resting on one foot only. The same naturalist remarks, that the white ibis sometimes goes alone, and sometimes in small troops of from eight to ten, while the black species, more numerous, forms flocks of from thirty to forty.

The *Scarlet ibis* is a native of South America. These birds live almost always in flocks, and the old ones most frequently form distinct and separate bands. Their flight is rapid and sustained, but they do not put themselves in motion, except in the morning and evening, for the purpose of seeking their food, which consists of insects, shell animals, and small fishes, collected in the slime along the sea-coast, or at the mouths of rivers. During the greatest heat of the day and at night, they remain in sheltered places. The broods commence in January, and are concluded in May. They deposit their eggs, which are greenish, in large tufts of grass, or in little piles collected

in the brush-wood. These ibides are spread throughout the warmest countries of America, and being not at all wild they are easily accustomed to live in houses. M. de la Borde mentions his having kept one for more than two years. It was fed with bread raw or cooked meat, and fish; but it gave the preference to the entrails of fish and fowl. It would frequently occupy itself in seeking for earth-worms round the house, or following the labours of a negro gardener. In the evening, this bird would retire of itself into a poultry-house, where it reposed in the midst of a hundred fowl. It would perch on the highest bar, awake very early in the morning, fly round the house, and sometimes proceed to the sea-shore. It would attack cats with great intrepidity. It would have lived longer, had it not been accidentally killed, by a fowler, who mistook it for a wild curlew, when it was on a pond. All this shows the possibility of rearing, in the warmer climates of Europe, a bird which, according to the testimony of Laet, has already produced in a domestic state, and may, perhaps, one day be turned to good account.

CHAP. IV.

OF THE BALEARIC AND OTHER FOREIGN CRANES.

HAVING ended the last chapter with doubts concerning the ibis, we shall begin this with doubts concerning the Balearic crane. Pliny has described a bird of the crane kind with a topping resembling that of the green woodpecker. This bird for a long time continued unknown, till we became acquainted with the birds of tropical climates, when one of the crane kind with a topping was brought into Europe, and described by Aldrovandus as Pliny's Balearic crane. Hence these birds, which have since been brought from Africa and the East in numbers, have received the name of Balearic cranes, but without any just foundation. The real Balearic crane of Pliny seems to be the lesser ash-coloured heron, with a topping of narrow white feathers; or perhaps the egret, with two long feathers that fall back from the sides of the head. The bird that we are about to describe under the name of the Balearic crane, was unknown to the ancients, and the heron or egret ought to be reinstated in their just title to that name.

When we see a very extraordinary animal, we are naturally led to suppose that there must be something also remarkable in its history, to correspond with the singularity of its figure. But it often happens that history fails on those occasions where we most desire information. In the present instance, in particular, no bird presents to the eye a more whimsical figure than this, which we must be content to call the Balearic crane. It is pretty nearly of the shape and size of the ordinary crane, with long legs and a long neck, like others of the kind; but the bill is shorter, and the colour of the feathers of a dark greenish gray. The head and throat form the most striking part of this bird's figure. On the head is seen, standing up, a thick round crest,

made of bristles, spreading every way, and resembling rays standing out in different directions. The longest of these rays are about three inches and a half, and they are all topped with a kind of black tassels, which give them a beautiful appearance. The sides of the head and cheeks are bare, whitish, and edged with red; while underneath the throat hangs a kind of bag or wattle, like that of a cock, but not divided into two. To give this odd composition a higher finishing, the eye is large and staring; the pupil black and big, surrounded with a gold-coloured iris, that completes the bird's very singular appearance.

From such a peculiar figure, we might be led to wish for a minute history of its manners; but of these we can give but slight information. This bird comes from the coast of Africa and the Cape de Verde Islands. As it runs, it stretches out its wings, and goes very swiftly, otherwise its usual motion is very slow. In their domestic state, they walk very deliberately among other poultry, and suffer themselves to be approached (at least it was so with that I saw) by every spectator. They never roost in houses; but about night, when they are disposed to go to rest, they search out some high wall, on which they perch in the manner of a peacock. Indeed, they so much resemble that bird in manners and disposition, that some have described them by the name of the *sea peacock*: and Ray has been inclined to rank them in the same family. But though their voice and roosting be similar, their food, which is entirely upon greens, vegetables, and barley, seems to make some difference.¹

¹ The Gigantic crane is a very large species of the Stork genus, measuring from tip to tip of the wings nearly fifteen feet. The bill is of a vast size, nearly triangular, and sixteen inches round at the base. The head and neck are naked, except a few straggling curled hairs. The feathers of the back and wings are of a bluish ash colour, and very stout; those of the breast are long. The craw hangs down the fore part of the neck like a pouch. The belly is covered with a dirty white down; and the upper part of the back and shoulders are surrounded with the same. The legs and half the thighs are naked; and the naked parts are full three feet in length. This bird is an inhabitant of Bengal and Calcutta, and is sometimes found on the coast of Guinea. It arrives in the internal parts of Bengal before the period of the rains, and retires as soon as the dry season commences. Its aspect is filthy and disgusting; yet it is one of the most useful birds of these countries, in clearing them of snakes and noxious reptiles and insects. It seems to finish the work begun by the jackal and vulture; they clearing away the flesh of animals, and these birds removing the bones by swallowing them entire. They sometimes feed on fish; and one of them will generally devour as much as would serve four men. On opening the body of a gigantic crane, a land tortoise ten inches long, and a large black male cat, were found entire within it; the former in the craw, and the latter in the stomach. Being altogether undaunted at the sight of mankind, they are soon rendered familiar; and when fish or other food are thrown to them, they catch them very nimbly, and swallow them whole. The gigantic

In this chapter of foreign birds of the crane kind, it will be proper to mention the Jabiru and the Jabiru Guacu, both natives of Brazil. Of these great birds of the crane kind we know but little, except the general outline of their figure, and the enormous bills which we often see preserved in the cabinets of the curious. The bill of the latter is red, and thirteen inches long; the bill of the former is black, and is found to be eleven. Neither of them, however, are of a size proportioned to their immoderate length of bill.—The jabiru guacu is not above the size of a common stork, while the jabiru with the smallest bill exceeds the size of a swan. They are both covered with white feathers, except the head and neck, that are naked; and their principal difference is in the size of the body and the make of the bill; the lower chap of the jabiru guacu being broad, and bending upwards.²

cranes are believed by the Indians to be animated by the souls of the Bramins, and consequently invulnerable. They are held in the highest veneration both by the Indians and Africans. Mr. Ives, in attempting to kill some of them with his gun, missed his shot several times; which the by-standers observed with the greatest satisfaction, telling him triumphantly that he might shoot at them as long as he pleased, but he never would be able to kill them. Gigantic cranes are found in companies; and when seen at a distance, near the mouths of rivers, coming towards an observer (which they do with their wings extended), it is said that they may be easily mistaken for canoes on the surface of a smooth sea; and when on the sand-banks, for men and women picking up shell-fish on the beach.

² The jabirus are not considered by Illiger and Temminck as forming a distinct genus from the storks. But Linnæus, Latham, Lacepede, and other ornithologists, have not hesitated to form a separate genus of this bird, under the name of *Mycteria*, giving as the principal character the slight recurvation of the bill upwards. In other respects, the characters of the jabirus resemble those of the storks. The American jabiru is described by Azara under the name of *Collier Rouge*, and is called in Paraguay *Aiaiai*. It also inhabits Brazil, where it is named *Jabiru Guacu*, and is found in some other parts of South America. It is the *Negro* of the Hollanders, and the *Touyouyou* of the native tribes of French Guiana. It is one of the largest and strongest of shore-birds. It is mounted on very high stilts, and its body is as bulky and more elongated than that of the swan. The skin of the neck is wrinkled, and so flaccid that it depends like the dewlap of a cow. This circumstance has given rise to the name of *Jabiru*, which in the language of the Guaranis signifies anything inflated by the wind. The legs, very robust, are covered with large scales, and denuded of feathers for about the space of six inches. The jabirus constantly inhabit the humid grounds of South America, and are found in considerable abundance in the inundated savannahs of Guiana. They never quit their sojourn but to rise slowly into the heights of the atmosphere, where they support themselves for a very long time. These birds are voracious, and live only on fish and reptiles. They construct, on lofty trees, with long branches carefully interlaced, a spacious nest, in which the female deposits but one or two eggs. The young are fed with fish until they are strong enough to descend from the nest, and are defended by the parents with great

A bird still more extraordinary may be added to this class, called the *anhima*, and, like the two former, a native of Brazil. This is a water-fowl of the rapacious kind, and bigger than a swan. The head, which is small for the size of the body, bears a black bill, which is not above two inches long; but what distinguishes it in particular is a horn growing from the forehead as long as the bill, and bending forward like that of the fabulous unicorn of the ancients. This horn is not much thicker than a crow-quill, as round as if it were turned in a lathe, and of an ivory colour. But this is not the only instrument of battle this formidable bird carries; it seems to be armed at all points; for at the fore-part of each wing, at the second joint, spring two straight triangular spurs, about as thick as one's little finger: the foremost of these goads or spurs is above an inch long; the hinder is shorter, and both of a dusky colour. The claws also are long and sharp; the colour is black and white; and they cry terribly loud, sounding something like *Vyhoo, Vyhoo*. They are never found alone, but always in pairs; the cock and hen prowl together; and their fidelity is said to be such, that when one dies, the other never departs from the carcass, but dies with its companion. It makes its nest of clay, near the bodies of trees, upon the ground, of the shape of an oven.

One bird more may be subjoined to this class, not for the oddity of its figure, but the peculiarity of its manners. It is vulgarly called by our sailors the *buffoon bird*, and by the French the *demoiselle*, or *lady*. The same qualities have procured it these different appellations from two nations, who, on more occasions than this, look upon the same objects in very different lights. The peculiar gestures and contortions of this bird, the proper name of which is the *Numidian crane*, are extremely singular; and the French, who are skilled in the arts of elegant gesticulation, consider all its motions as lady-like and graceful. Our English sailors, however, who have not entered so deeply into the dancing art, think, that while thus in motion, the bird cuts but a very ridiculous figure. It stoops, rises, lifts one wing, then another, turns round, sails forward, then back again; all which highly diverts our seamen; not imagining, perhaps, that all these contortions are but the awkward expression, not of the poor animal's pleasures, but its fears.³

courage. This nest is said to serve for several broods. The jabirus appear to be less wild in Guiana than in Paraguay. Bajon tells us that in 1773 a little negro contrived, by merely concealing his face with the branch of a tree, to approach a young one that had almost acquired its full growth, sufficiently near to seize it by the legs and catch it. The flesh of the old is hard and oily; but that of the young is tender, and tolerably good eating.—Ed.

³ The *Demoiselle heron*, *Ardea virgo*, *Grus virgo*, *Demoiselle de Numidie*, &c., owes its name to its elegant gait, the ornamental plumes of its head, and certain mimic gestures which it makes,—inclining its

It is a very scarce bird; the plumage is of a leaden gray; but it is distinguished by fine white feathers, consisting of long fibres, which fall from the back of the head, about four inches long; while the fore-part of the neck is adorned with black feathers, composed of very fine, soft, and long fibres, that hang down upon the stomach, and give the bird a very graceful appearance. The ancients have described a buffoon bird; but there are many reasons to believe that theirs is not the Numidian crane. It comes from that country from whence it has taken its name.

CHAP. V.

OF THE HERON, AND ITS VARIETIES.

BIRDS of the crane, the stork, and the heron kind, bear a very strong affinity to each other: and their differences are not easily discernible.¹

head, walking with a kind of ostentatious air, and leaping and bounding as if it were about to dance. All these peculiarities of the *demoiselle* of Numidia are mentioned by many ancient writers; and Xenophon in Athenæus speaks of a stratagem by which these birds might be caught, which consisted in rubbing one's self with water in their presence, and then filling the vessel with glue before going away. Notwithstanding this, the acquaintance of the moderns with this species is comparatively of recent date. They at first confounded it with the *Scops* and *Otus* of the Greeks, and *Asio* of the Latins, in consequence of the gestures which that owl makes with its head, and by mistaking its ears for the tuft of slender threads which covers those of the *demoiselle*. M. de Savigny, in his observations on the system of the birds of Egypt and Syria, demonstrates, with much acumen, that the bird in question here is the *Crex* of the Greeks; and he also mentions that it is the *Bibio*, or *Grus Balearica*, and *Grus minor*, of the Latins, though ornithologists place these denominations in the synonymy of the preceding species. These birds are found in various parts of Africa and Asia, in the interior of the countries of the Cape of Good Hope, but more particularly in the ancient Numidia; and they are observed to arrive in Egypt at the epoch of the inundation of the Nile. Some are also found on the southern coasts of the Black Sea, and the Caspian; but it is invariably marshy places which they frequent. They feed indifferently on grains, insects, worms, shell-mollusca, and even small fishes, which they catch with great dexterity. Their cry resembles the clamorous tones of the crane, but is much more feeble, and sharper.—Ed.

¹ Cranes are distinguished by having the head bald; storks have the orbits round the eyes naked; and herons have the middle claw serrated internally. Herons comprehend the species known under the names of egrets, bitterns, crab-eaters, &c. In the genus *Ardea*, now limited to the herons and bitterns, the bill is considerably longer than the head, sharp at the point, straight or very slightly curved, compressed laterally, cleft to the very base, and frequently armed at the edges with sharp denticulations; the upper mandible is marked on either side by a longitudinal groove, in which the linear nostrils are perforated near the base of the bill; from the bill to the eyes extends a space destitute of feathers; the tarsi are long and covered with large scales; the

As for the crane and the stork, they differ rather in their nature and internal conformation; than in their external figure; but still they may be known asunder, as well by their colour as by the stork's claws, which are very peculiar, and more resembling a man's nails than the claws of a bird. The heron may be distinguished from both, as well by its size, which is much less, as by its bill, which in proportion is much longer; but particularly by the middle claw on each foot, which is toothed like a saw, for the better seizing and holding its slippery prey. Should other marks fail, however, there is an anatomical distinction, in which herons differ from all other birds; which is, that they have but one cœcum, and all other birds have two.

Of this tribe, Brisson has enumerated not less than forty-seven sorts, all differing in their size, figure, and plumage; and with talents adapted to their place of residence, or their peculiar pursuits. But, how various soever the heron kind may be in their colours or their bills, they all seem possessed of the same manners, and have but one character of cowardice, rapacity, and indolence, yet insatiable hunger. Other birds are found to grow fat by an abundant supply of food; but these, though excessively destructive and voracious, are ever found to have lean and carrion bodies, as if not even plenty were sufficient for their support.

The common heron is remarkably light, in proportion to its bulk, scarcely weighing three pounds and a half, yet it expands a breadth of wing which is five feet from tip to tip. Its bill is very long, being five inches from the point to the base; its claws are long, sharp, and the middlemost toothed like a saw. Yet, thus armed as it appears for war, it is indolent and cowardly, and even flies at the approach of a sparrow-hawk. It was once the amusement of the great to pursue this timorous creature with the falcon: and heron-hawking was so favourite a diversion among our ancestors, that laws were enacted for the preservation of the species; and the person who destroyed their eggs was liable to a penalty of twenty shillings for each offence.²

legs naked for some distance above the knee-joints; the toes long and slender, the outer one united to the middle by a membranous expansion, and the posterior attached so low down as to allow of its resting its whole length upon the ground; the anterior claws of moderate length, slightly curved and pointed, with a denticulated dilatation on the inner side of that of the middle toe; the posterior claw very long, arched, and pointed; and the wings long, with the first quill-feathers shorter than the two succeeding ones, which are the longest of the series. Thus restricted, the genus is extremely numerous; for M. Vieillot states it to be composed of no fewer than eighty species. These are distributed by M. Cuvier into six sections or subdivisions, among which the true herons are principally distinguished by the great length of their legs and neck, the long pendant plumes of the lower part of the neck, and the perfectly straight direction of the bill.—Ed.

² See Supplementary Note B, p. 179.

At present, however, the defects of the ill-judged policy of our ancestors is felt by their posterity; for, as the amusement of hawking has given place to the more useful method of stocking fish-ponds, the heron is now become a most formidable enemy. Of all other birds, this commits the greatest devastation in fresh waters; and there is scarce a fish, though never so large, that he will not strike at and wound, though unable to carry it away. But the smaller fry are his chief subsistence; these, pursued by their larger fellows of the deep, are obliged to take refuge in shallow waters, where they find the heron a still more formidable enemy. His method is to wade as far as he can go into the water, and there patiently wait the approach of his prey, which, when it comes within sight, he darts upon it with inevitable aim.³ In this manner he is found to destroy more in a week than an otter in three months. "I have seen a heron," says Willoughby, "that had been shot, that had seventeen carps in his belly at once, which he will digest in six or seven hours, and then to fishing again. I have seen a carp," continues he, "taken out of a heron's belly, nine inches and a half long. Several gentlemen who kept tame herons, to try what quantity one of them would eat in a day, have put several smaller roach and dace in a tub; and they have found him eat fifty in a day, one day with another. In this manner a single heron will destroy fifteen thousand carp in half-a-year."⁴

³ "The times at which the heron resorts to the water to fish, are those at which the fish come to the shores and shallows to feed upon insects, and when, as they are themselves plashing and dimpling the water, they are the least apt to be disturbed by the motions of the heron. The bird alights in a quiet way, then wades into the water to its depth, folds its long neck partially over its back, and forward again, and with watchful eye, awaits till a fish comes within the range of its beak. Instantaneously it darts, and the prey is secured. That it should fish only in the absence of the sun is also a wonderful instinct. Every one who is an angler, or is otherwise acquainted with the habits of fish in their native element, knows how acute their vision is, and how much they dislike shadows in motion, or even at rest projected from the bank. It is not necessary that the shadow should be produced by the bright sun; full daylight will do it; and we have seen a successful fly-fishing instantly suspended, and kept so for a considerable time, by the accidental passage of a person along the opposite bank of the stream; nay, we once had our sport interrupted by a cow coming to drink; so alarmed are fish, especially the trout and salmon tribe, at the motion of small shadows upon the water. There is one instance in which we have observed herons feeding indiscriminately in sun and shade; and that is, when a river is flooded to a great extent, and the flood has passed off, leaving the fish in small pools over the meadows. How the herons find out these occasions it is difficult to say; but we have seen several pairs come after a flood to a river which they never visited upon any other occasion, and within many miles of which a heronry, or even the nest of a single pair, was never observed."—*British Naturalist*.

⁴ Mr. J. C. Hurst, in the 'Magazine of Natural History,' gives the following interesting fact. "A

So great are the digestive powers of this freshwater tyrant, and so detrimental to those who stock ponds with fish. In general, he is seen taking his gloomy stand by the lake's side, as if meditating mischief, motionless, and gorged with plunder. His usual attitude on this occasion is to sink his long neck between his shoulders, and keep his head turned on one side, as if eyeing the pool more intently. When the call of hunger returns, the toil of an hour or two is generally sufficient to fill his capacious stomach; and he retires long before night to his retreat in the woods. Early in the morning, however, he is seen assiduous at his usual occupation.

But, though in seasons of fine weather the heron can always find a plentiful supply; in cold or stormy seasons, his prey is no longer within reach: the fish that before came into the shallow water, now keep in the deep; as they find it to be the warmest situation. Frogs and lizards also seldom venture from their lurking-places; and the heron is obliged to support himself upon his long habits of patience, and even to take up with the weeds that grow upon the water. At those times he contracts a consumptive disposition, which succeeding plenty is not able to remove; so that the meagre glutton spends his time between want and riot, and feels alternately the extremes of famine and excess. Hence, notwithstanding the care with which he takes his prey, and the amazing quantity he devours, the heron is always lean and emaciated; and though his crop be usually found full, yet his flesh is scarcely sufficient to cover the bones.

The heron usually takes his prey by wading into the water; yet it must not be supposed that he does not also take it upon the wing. In fact, much of his fishing is performed in this manner; but he never hovers over deep waters, as there his prey is enabled to escape him by sinking to the bottom. In shallow places he darts with more certainty; for though the fish at sight of its enemy instantly descends, yet the heron, with his long bill and legs, instantly pins it to the bottom, and thus seizes it securely. In this

heron was run down and captured by a boy in Bexley marshes, which contained in his stomach a *very large-sized* mature, male water-rat. It had been lately swallowed, occupying even to distention—with portions of partially digested fish—the ventriculus of the heron. The only injury apparent to the animal was, a puncture made by the beak of the bird in the frontal part of the skull, by which life was destroyed. On referring to the only works I have in my possession on ornithology, I find no mention of so large a creature as the rat constituting the food of the *Ardea* genus. I think it appears evident (as the bird was in good condition, and other food in the stomach), that, although the winter has been severe, yet necessity did not enforce such means to satisfy its hunger. The size of the œsophagus would also elicit a contradiction to its capability of such distension, if the proofs were not positive. No evident cause of its easy capture existed, but the probable one of repletion."—Ed.

manner, after having been seen with his long neck for above a minute under water, he rises upon the wing, with a trout or an eel struggling in his bill to get free. The greedy bird, however, flies to the shore, scarcely gives it time to expire, but swallows it whole, and then returns to fishing as before.

As this bird does incredible mischief to ponds newly stocked, Willoughby has given a receipt for taking him.—“Having found his haunt, get three or four small roach or dice, and having provided a strong hook with a wire to it, this is drawn just within-side the skin of the fish, beginning without-side the gills, and running it to the tail, by which the fish will not be killed, but continue for five or six days alive. Then having a strong line made of silk and wire, about two yards and a half long, it is tied to a stone at one end, the fish with the hook being suffered to swim about at the other. This being properly disposed in shallow water, the heron will seize upon the fish to its own destruction. From this method we may learn, that the fish must be alive, otherwise the heron will not touch them, and that this bird, as well as all those that feed upon fish, must be its own caterer; for they will not prey upon such as die naturally, or are killed by others before them.”

Though this bird lives chiefly among pools and marshes, yet its nest is built on the tops of the highest trees, and sometimes on cliffs hanging over the sea. They are never in flocks when they fish, committing their depredations in solitude and silence; but in making their nests they love each other's society; and they are seen, like rooks, building in company with flocks of their kind. Their nests are made of sticks, and lined with wool; and the female lays four large eggs of a pale green colour. The observable indolence of their nature, however, is not less seen in their nestling than their habits of depredation. Nothing is more certain, and I have seen it a hundred times, than that they will not be at the trouble of building a nest, when they can get one made by the rook, or deserted by the owl, already provided for them. This they usually enlarge and line within, driving off the original possessors, should they happen to renew their fruitless claims.⁵

⁵ Instances are on record of herons and rooks building their nests contiguous to each other, and living on better terms, upon the whole, than many neighbours of whom more might be expected. “There were,” says Dr. Heysham, of Carlisle, “two groves adjoining the park: one of which, for many years, had been resorted to by a number of herons, which there built and bred; the other was one of the largest rookeries in the country. The two tribes lived together for a long time without any disputes. At length the trees occupied by the herons, consisting of some very fine old oaks, were cut down in the spring of 1775, and the young had perished by the fall of the timber. The parent birds immediately set about preparing new habitations in order to breed again; but as the trees in the neighbourhood of their

The French seem to have availed themselves of the indolence of this bird in making its nest; and they actually provide a place with materials fitted for their nestling, which they call *heronries*. The heron, which with us is totally unfit for the table, is more sought for in France where the flesh of the young ones is in particular estimation. To obtain this the natives raise up high sheds along some fishy stream; and furnishing them with materials for the herons to nestle with, these birds build and breed there in great abundance. As soon as the young ones are supposed to be fit, the owner of the heronry comes, as we do into a pigeon-house, and carries off such as are proper for eating; and these are sold for a very good price to the neighbouring gentry. "These are a delicacy which," as my author says, "the French are very fond of, but which strangers have not yet been taught to relish as they ought." Nevertheless, it was formerly much esteemed as a food in England, and made a favourite dish at great tables. It was then said that the flesh of a heron was a dish for a king; at present nothing about the house will touch it but a cat.

With us, therefore, as the heron, both old and young, is thought detestable eating, we seldom trouble these animals in their heights, which are for the most part sufficiently inaccessible. Their nests are often found in great numbers in the middle of large forests, and in some groves nearer home, where the owners have a predilection for the bird, and do not choose to drive it from its accustomed habitations. It is certain that by their cries, their expansive wings, their bulk, and wavy motion, they add no small solemnity to the forest, and give a pleasing variety to a finished improvement.

When the young are excluded, as they are numerous, voracious, and importunate, the old ones are for ever upon the wing to provide them with abundance. The quantity of fish they take upon this occasion is amazing, and their size is not less to be wondered at. I remember a heron's nest that was built near a school-house; the boys, with their usual appetite for mischief, climbed up, took down the young ones, sewed up their vents, and laid them in the nest as before. The pain the poor little animals felt

old nests were only of a late growth, and not sufficiently high to secure them from the depredations of boys, they determined to effect a settlement in the rookery. The rooks made an obstinate resistance; but, after a very violent contest, in the course of which many of the rooks, and some of their antagonists, lost their lives, the herons at last succeeded in their attempt, built their nests, and brought out their young. "The next season the same contest took place, which terminated like the former, by the victory of the herons. Since that time peace seems to have been agreed upon between them; the rooks have relinquished possession of that part of the grove which the herons occupy; the herons confine themselves to those trees they first seized upon, and the two species live together in as much harmony as they did before their quarrel."

from the operation increased their cries; and this but served to increase the diligence of the old ones in enlarging their supply. Thus they heaped the nest with various sorts of fish, and the best of their kind; and as their young screamed, they flew off for more. The boys gathered up the fish, which the young ones were incapable of eating, till the old ones at last quitted their nest; and gave up their brood, whose appetites they found it impossible to satisfy.

The heron is said to be a very long-lived bird; by Mr. Keysler's account, it may exceed sixty years; and by a recent instance of one that was taken in Holland, by a hawk belonging to the Stadtholder, its longevity is again confirmed, the bird having a silver plate fastened to one leg, with an inscription, importing that it had been struck by the elector of Cologne's hawks thirty-five years before.

SUPPLEMENTARY NOTE A.

The Common heron is, as its name implies, one of the most frequent and best known species of the group. It is about three feet four inches in length, measuring from the end of the anterior toes to the extremity of the bill; from the bill to the tail it measures nearly three feet, of which the tail forms about eight inches; and the expanse of its wings exceeds five feet. It does not, however, weigh more than three pounds and a half, and its buoyancy in flight is consequently very considerable. The general colour of the whole upper surface of the bird is an ashy gray with somewhat of a bluish tinge. This is deeper on the back of the head, which is likewise ornamented with a dependent crest of narrow blackish feathers, three inches or more in length, overshadowing the back of the neck. The upper part and sides of the neck are of a light gray, running into the pure ash-colour of the back, and the latter passing into a deeper shade of ashy gray upon the tail. The wing-coverts are nearly of the same colour, with a slight tinge of reddish; and the quill-feathers black with a bluish gloss. On the under parts the ground-colour of the plumage is a pure white, marked on the fore part of the neck and breast with large longitudinal black drops. The abdomen, upper part of the throat, and legs, are pure white. The naked space between the bill and the eyes is of a grayish yellow; the iris is yellow; the bill bluish above and yellow beneath; the legs, which are bare of feathers for two or three inches above the knees, are somewhat flesh-coloured in their upper part and grayish brown below; and the claws black. The middle toe, with the addition of its claw, does not measure more than four inches; and is consequently much shorter than the tarsus, which exceeds six inches in length. Beneath the anterior half of the bill, which is about five inches long, the skin is capable of considerable distention. There is little difference in the colours of the female; but the young bird has no crest on the head, and its back and wings are of a darker gray.

The herons may be regarded as birds of passage, but their stay or departure seems everywhere to be regulated by their means of procuring food. They are nowhere very abundant, although they are met with in almost every part of the northern and temperate regions of the Old continent, and perhaps also in the New. In Europe they migrate as far northward as Drontheim, and are found even in Russia and Poland, but they are most common in England, France, and Holland.

They build their nests, in numerous companies, on lofty trees, and more especially oaks, in the immediate neighbourhood of streams and marshes. The nest is of large dimensions, constructed externally of twigs, dry herbs and reeds, and lined internally with feathers and wool. In this the female deposits her eggs, three or four in number, about the size of those of the common hen, but more elongated, and of a greenish brown colour without spots. The male does not share in the task of incubation; but flies abroad in search of food, while the female tends her charge at home. They are particularly fond of the society of ravens, but the latter often carry off their eggs; and the falcons, weasels, and martens, are dangerous enemies to their young. When the young are hatched, both parents assist in providing them with food until they are able to fly, and bring them abundance of fish for their support. But as soon as they become capable of a continued flight they are driven from the nest, and proceed each in a separate direction to seek its own subsistence wherever it may be most plentifully procured.

The old birds quit their nests about the middle of August, and wander from stream to stream, and from lake to lake, forming themselves into gradually increasing bands as the colder season approaches. Towards the beginning of September they are often met with in companies of from twenty to thirty in a spot; but as soon as the frost sets in, they begin their migration to the southward, taking their flight by moonlight, like the cranes, but not with the same order and regularity. They return about the latter end of March, when the severity of the season is no longer to be dreaded. Some few, however, remain throughout the winter, especially when the weather is variable, and are occasionally seen, in company with the wild ducks, at the commencement of a sudden thaw. They usually disappear with the return of frost.

Their food consists principally, like that of most of the birds of the wading order, of fresh-water fishes, but more particularly of the young fry of carp and trout. In pursuit of these they wade gently into the water, where the fish abound, and stand in it up to their knees, (or rather to their knee, for they rest only on one foot,) with their heads drawn in by the folding of their long necks upon the breast, quietly watching the approach of their prey. It has been remarked, not merely by the vulgar, but by observers deserving of implicit confidence, that the fish generally swarm around them in sufficient number to afford them a plentiful supply; and this has been commonly accounted for on the supposition that their legs communicate a peculiar odour to the water which entices the fish to their destruction. But M. Bechstein, who vouches for the fact as one which he had seen innumerable times, suspects that the source of attraction is in the excrements of the bird, which it lets fall into the water, and which the fish, as is proved by experiment, devour with the utmost avidity. The time of fishing is usually before sunrise or after sunset. They generally swallow their prey entire, and many stories are current of eels escaping alive through their intestines, and being a second time devoured by the voracious birds. Besides fishes, frogs form a considerable portion of their food, and in winter they are frequently compelled to content themselves with snails and worms, or, according to M. de Salerne, even with the duckweed that floats upon the stagnant waters. At such times they occasionally become so emaciated as to appear to consist of little else than feathers and bones.

Heron is taken in various ways. Sometimes they are shot while fishing, or sweeping leisurely along the banks; but they are so shy that the sportsman can rarely get within gunshot of them. Occasionally a living fish is attached to a hook at the end

of a line, and left to swim in the waters which they are known to frequent; and they are thus caught as it were by angling. When falconry was in fashion, hawking at the heron was regarded as the most noble of its branches; the powerful wings of the heron, unequalled by any bird of its size, enabling it to mount in the air to an almost incredible height and thus to put the powers of the falcon to their proof. For this purpose it was customary to establish the herons in a proper situation, to which they were attached by precautions taken for providing them with necessaries. These heronries, as they were called, have now become extremely rare in Scotland; but one of them may still be seen in the parish of Craigie, near Kilmarnock, in Ayrshire. Mr. Rennie says that the heronries recorded to be existing at present in England, are at Penhurst-place, Kent; at Hutton, the seat of Mr. Bethel, near Beverly, in Yorkshire; at Pixton, the seat of Lord Caernarvon; in Gobay-park, on the road to Penrith, near a rocky pass called Yew-crag, on the north side of the romantic lake of Ulswater; at Cressie-hall, six miles from Spalding, in Lincolnshire; at Downington-in-Holland, in the same county; at Brackley-woods near Bristol; at Brownsea-island, near Poole, in Dorsetshire; and at Windsor.

"I went lately to see a fine heronry at Sir Henry Fletcher's park, Walton-on-Thames," says Mr. Jesse. "The nests are built on the top of some of the finest fir trees in the kingdom, and appear somewhat larger than those of the rooks. These birds must go an amazing distance to provide for their young, as I have been assured that the bones of sea-fish have been found under their nests. A young bird from this heronry, having fallen out of the nest, was taken away in the evening by a gentleman, who carried it to his house at some miles' distance, and turned it into a walled garden that night, the next morning one of the old birds was seen to feed it, and continued to do so till the young one made its escape. This bird must have gone over a very considerable space of ground in search of the young heron."

"A large assembly of herons takes place at certain times of the year in Richmond-park, where I have counted from fifty to sixty at a time. Sometimes they may be seen on the tops of trees, and at others on the ground at a distance from the ponds, appearing perfectly motionless till they are disturbed. This assemblage is very curious. The nearest heronry from Richmond-park is the one near Walton-on-Thames, and the other in Windsor great park, both of which would scarcely furnish the number above mentioned. There seems to be no reason why they should congregate and remain for so long a time in the listless manner in which I have seen them; nor can one give a probable reason, why the birds from two heronries should meet at the same time in a place so far distant from their usual haunts. It is seldom that one sees more than two or three herons together in the same place, and this only when they are watching their prey."

"Belon mentions it as one of the extraordinary feats performed by the divine king, Francis the First, that he formed two artificial heronries at Fontainebleau, — 'the very elements themselves,' says he, 'obeying the commands of this divine king (whom God absolve!) for to force nature is a work partaking of divinity.' In order to enhance the merits of these French heronries, he undertakes to assert, that they were unknown to the ancients, because they are not mentioned in any of their writings; and for the same reason he concludes there are none in Britain. Before Belon's time, on the contrary, and before the "divine" constructor of heronries in France was born, there were express laws enacted in England for the protection of herons, it being a fine of ten shillings to take the young out of the

nest, and six shillings and eight-pence for a person without his own grounds, killing a heron, except by hawking, or by the long-bow; while in subsequent enactments, the latter penalty was increased to twenty shillings, or three months' imprisonment. At present, however, in consequence of the discontinuance of hawking, little attention is paid to the protection of heronries, though, I believe, none of the old statutes respecting them have been repealed. Not to know a hawk from a *heronshaw* (the former name of the heron) was an old adage, which arose when the diversion of heron-hawking was in high fashion: it has since been corrupted into the absurd vulgar proverb, "not to know a hawk from a hand-saw."

The heron, when taken young, readily becomes habituated to captivity; but the old birds generally refuse all sustenance, and perish of inanition. In former days, when it was necessary to procure such for the training of the hawks, it was usual, according to Sir J. Sebright, "to cram them with food, and to tie a piece of mat round their necks to prevent them from throwing it up again." Sometimes, however, the old birds have been known to become tame and even domesticated; and the same distinguished authority to whom we have just referred, mentions an instance that occurred within his own knowledge, in which, after recourse had been had to the operation of cramming and tying down the food, the bird "became so tame as to follow its master on the wing to the distance of some miles, to come into the house when called, and to take food from the hand."

The *Night heron*, so called from the hoarse croaking which it utters during the night, is about twenty inches in length. The bill is three inches and three quarters long, slightly arched, strong, and black, inclining to yellow at the base; the skin from the beak round the eyes is bare, and of a greenish colour, irides yellow. A white line is extended from the beak over each eye; a black patch, glossed with green, covers the crown of the head and nape of the neck, from which three long narrow white feathers, tipped with brown, hang loose and waving; the hinder part of the neck, coverts of the wings, the sides and tail, are ash-coloured; throat white; fore-part of the neck, breast, and belly, yellowish white or buff; the back black; the legs a greenish yellow. The female is nearly of the same size as the male; but she differs considerably in her plumage, which is less bright and distinct, being more blended with clay or dirty white, brown, gray, and rusty ash-colour; and she has not the delicate plumes that flow from the head of the male. The night heron frequents the sea-shores, rivers, and inland marshes; and lives upon insects, slugs, frogs, reptiles, and fish. It remains concealed during the day, and does not roam abroad until the approach of night, when it is heard, and known by its harsh, rough, and disagreeable cry, which is by some compared to the noise made by a person straining to vomit. Some ornithologists affirm that the female builds her nest in trees; others, that she builds it on rocky cliffs; probably both accounts are right. She lays three or four white eggs.

The *Crested purple heron* inhabits Asia, and is two feet ten inches in length. The bill is brown, tipped with dusky brown, and is yellowish beneath; the crest is of a black colour; the orbits naked and yellowish; from the angle of the mouth to the hind-head it has a black streak; the chin is white; upper half of the neck rufous, with three longitudinal black lines; the rest olive behind, and rufous at the sides, and reddish on the fore-part; the feathers are long, narrow, each marked with a black spot; a black band passes from the middle of the breast to the vent; the lower tail-coverts are white, mixed with rufous and tipped with black; angles of the wings rufous; the quill feathers dusky; and the legs

greenish; hind-head black; the crest pendent, consisting of two long feathers; the body is of an olive colour, and beneath it is purplish.

The smaller herons with shorter feet have been called *Crab-eaters*. The *Egrets* are herons, whose plumes on the lower part of the back are, at a certain period, long and attenuated. These plumes were formerly used to decorate the helmets of warriors; they are now applied to a gentler and better purpose, in ornamenting the head-dresses of the European ladies, and the turbans of the Persians and Turks.

NOTE B.—*Heron-hawking.*

The following interesting account of heron-hunting with falcons, is from the 'Magazine of Natural History,' and though it might have been more appropriately introduced, perhaps, when we were speaking of birds of prey, it is too good, we think, to be omitted, and incidentally illustrates the character of the species under consideration.

"In June, 1825," says the writer, "happening to be in Norfolk, I became an eye-witness to that most ancient and now very rare sport of falconry; and I now relate what I actually saw, and which was to me most novel and entertaining. The place fixed upon for the sport was in the intermediate country between the fens and the heronry, and in the afternoon of the day, with the wind blowing towards the heronry. There were four couple of casts of the female Peregrine falcon carried by a man to the ground, upon an oblong kind of frame padded with leather, upon which the falcons perched, and were fastened to the perch by a thong of leather. Each bird had a small bell on one leg, and a leather hood, with an oblong piece of scarlet cloth stitched into it over each eye, surmounted by a plume of various-coloured feathers on the top of the hood. The man walked in the centre of the frame, with a strap from each side over each shoulder; and when he arrived at the spot fixed upon for the sport, he set down the frame upon its legs, and took off all the falcons, and tethered them to the ground in a convenient shady place. There were four men who had the immediate care of the falcons (seemingly Dutch or Germans), each having a bag, somewhat like a woman's pocket, tied to his waist, containing a live pigeon, called a lure, to which was fastened a long string; there were also some gentlemen attached to the sport, who likewise carried their bags and lures.

"After waiting awhile, some herons passed, but at too great a distance; at length one appeared to be coming within reach, and preparations were made to attack him. Each falconer was furnished with a brown leather glove on the right hand (I suppose to prevent the talons of the bird from scratching it), on which the falcon perched; and there was a small bit of leather attached to the leg of the bird, and which was held by the falconer between the thumb and finger. Each of the men thus equipped, with a falcon on one fist, and the bag with the lure tied to the waist, and mounted on horseback, proceeding slowly in a direction towards where the heron was seen approaching. As soon as the heron was nearly opposite, and at what I conceived a great height in the air, the falconers slipped the hoods from off the heads of the falcons, and held each bird on the fist by the bit of leather till the falcons caught sight of the heron, and then a most gallant scene ensued. The instant they were liberated, they made straight for their prey, though at a considerable distance a-head. As they were dashing away towards the heron, a crow happened to cross; and one of them instantly darted at him, but he struck into a plantation and saved himself: the falcon dashed in after him, but did not take him. The other falcon soon overtook the heron (which immediately disgorged its

ballast of two or three fishes); and after flying round in circles for some time, at length soared above him, and then struck him on the back; and they both came tumbling down together, from an exceeding great height, to the ground. The other falcon, having lost some time with the crow, was flying very swiftly to assist his comrade, and had just come up at the time the falcon and heron were falling. At this instant a rook happened to fly across; the disappointed falcon struck at him, and they both fell together within twenty yards of the other falcon and the heron. When on the ground, each falcon began to pull to pieces its victim; but, as soon as the falcons rode up, the lures were thrown out, and the falcons suffered to make a meal (having previously been kept fasting) upon the pigeon, which was laid on the carcass of the heron; and, after they were satisfied, were again hooded and put up for that day.

"The next cast consisted of two younger birds; and when let loose at another heron, they flew up to it very well. But the heron was an old one and supposed to have been caught before; for the moment he was aware of his enemies below, he began to soar into the air, and set up a loud croak: and these, not so experienced, would not attack him, but soared about, and left him. Upon this, one of the falcons set up a peculiar call, to which, no doubt, the birds were trained; when one of them, from a very great elevation in the air, immediately closed his wings, darted down to the man who called him, and was taken in hand. This was a very extraordinary manœuvre, and an instance of tractable sagacity. The other falcon did not come to the call, but sailed about in the air. At length a heron crossed, and the falcon attacked it, but again left it. A third heron also came in his way: this he also fell to work with, and, after a short struggle, brought him to the ground in the same style as the first. This last heron had his wing broken, and the falconer killed him; but the first was taken alive, and was afterwards turned out before a single falcon, which struck him down in a minute. I understood, that, when a heron had once been taken by a falcon, he never made any more sport. It was the case with this one; for, the moment he saw his enemy coming towards him, he lost all his powers, and made a ridiculous awkward defence on the ground; where the falcon would soon have despatched him, if the falconer and his lure had not been near at hand.

"This sport was to me an extraordinary treat, from its novelty and the excitement which it caused; but there were circumstances attending it which would have made the farmers stare and swear in some counties, for the horsemen rode through fields of standing corn with as little ceremony as the tithe-man, but with much more celerity: and the sport was more dangerous than fox-hunting; for the eye, being constantly aloft to view the aerial diversion, the chasms and sinuosities of mother earth were not so observable as when the object of pursuit lay more at right angles with the vision of the pursuer."

CHAP. VI.

OF THE BITTERN, OR MIRE-DRUM.

THOSE who have walked in an evening by the sedgy sides of unfrequented rivers, must remember a variety of notes from different water-fowl: the loud scream of the wild-geese, the croaking of the mallard, the whining of the lapwing, and the tremulous neighing of the jack-snipe. But

of all those sounds, there is none so dismally hollow as the booming of the bittern. It is impossible for words to give those who have not heard this evening-call an adequate idea of its solemnity. It is like the interrupted bellowing of a bull, but hollower and louder, and is heard at a mile's distance, as if issuing from some formidable being that resided at the bottom of the waters.

The bird, however, that produces this terrifying sound, is not so big as a heron, with a weaker bill, not above four inches long. It differs from the heron chiefly in its colour, which is in general of a palish yellow, spotted and barred with black. Its windpipe is fitted to produce the sound for which it is remarkable; the lower part of it dividing into the lungs, is supplied with a thin loose membrane, that can be filled with a large body of air, and exploded at pleasure. These bellowing explosions are chiefly heard from the beginning of spring to the end of autumn; and, however awful they may seem to us, are the calls to courtship, or of connubial felicity.

From the loudness and solemnity of the note, many have been led to suppose, that the bird made use of external instruments to produce it, and that so small a body could never eject such a quantity of tone. The common people are of opinion that it thrusts its bill into a reed, that serves as a pipe for swelling the note above its natural pitch; while others, and in this number we find Thomson the poet, imagine that the bittern puts its head under water, and then violently blowing produces its boomings. The fact is, that the bird is sufficiently provided by nature for this call; and it is often heard where there are neither reeds nor waters to assist its sonorous invitations.

It hides in the sedges by day, and begins its call in the evening, booming six or eight times, and then discontinuing for ten or twenty minutes, to renew the same sound. This is a call it never gives but when undisturbed and at liberty. When its retreats among the sedges are invaded, when it dreads or expects the approach of an enemy, it is then perfectly silent. This call it has never been heard to utter when taken or brought up in domestic captivity; it continues under the control of man a mute forlorn bird, equally incapable of attachment or instruction. But though its boomings are always performed in solitude, it has a scream which is generally heard upon the seizing of its prey, and which is sometimes extorted by fear.

This bird, though of the heron kind, is yet neither so destructive nor so voracious. It is a retired timorous animal, concealing itself in the midst of reeds and marshy places, and living upon frogs, insects, and vegetables; and though so nearly resembling the heron in figure, yet differing much in manners and appetites. As the heron builds on the tops of the highest trees,

the bittern lays its nest in a sedgy margin, or amidst a tuft of rushes. The heron builds with sticks and wool; the bittern composes its simpler habitation of sedges, the leaves of water-plants, and dry rushes. The heron lays four eggs; the bittern generally seven or eight, of an ash-green colour. The heron feeds its young for many days; the bittern in three days leads its little ones to their food. In short, the heron is lean and cadaverous, subsisting chiefly upon animal food; the bittern is plump and fleshy, as it feeds upon vegetables when more nourishing food is wanting.

It cannot be, therefore, from its voracious appetites, but its hollow boom, that the bittern is held in such detestation by the vulgar. I remember, in the place where I was a boy, with what terror this bird's note affected the whole village; they considered it as the presage of some sad event; and generally found or made one to succeed it. I do not speak ludicrously; but if any person in the neighbourhood died, they supposed it could not be otherwise, for the night-raven had foretold it; but if nobody happened to die, the death of a cow or a sheep gave completion to the prophecy.

Whatever terror it may inspire among the simple, its flesh is greatly esteemed among the luxurious. For this reason, it is as eagerly sought after by the fowler, as it is shunned by the peasant; and as it is a heavy-rising slow-winged bird, it does not often escape him. Indeed, it seldom rises but when almost trod upon, and seems to seek protection rather from concealment than from flight. At the latter end of autumn, however, in the evening, its wonted indolence appears to forsake it. It is then seen rising in a spiral ascent, till it is quite lost from the view, making at the same time a singular noise, very different from its former boomings. Thus the same animal is often seen to assume different desires; and while the Latins have given the bittern the name of the star-reaching bird (or the *stellaris*), the Greeks, taking its character from its more constant habits, have given it the title of the *σφοδρ*, or the lazy.

SUPPLEMENTARY NOTE.

Bitterns are to be found in all countries where there are marshes. The *Little bittern* is not much bigger than the thrush, and is rare in Great Britain. The *Yellow bittern* is an inhabitant of Brazil, and is about two feet three inches in length.

The bittern is more plentiful in Scotland than in England, and inhabits marshy tracts. His remarkable note has been spoken of by many a poet. Thomson, believing erroneously, that the sound was made while the bird plunged its bill in the mud, says,—

—So that scarce
The bittern knows his time with bill engulfed,
To shake the sounding marsh."

And Southey says,—

"At evening o'er the swampy plain
The bittern's boom came far."

It is with much difficulty that this bird can be

roused from his lurking-place; but when he takes wing, his flight is rapid, high, and spiral, as the poet last-quoted observes,—

"Swift as the bittern soars on spiral wings."

Sir Walter Scott also beautifully alludes to this bird:—

"And the lark's shrill pipe shall come
In the morning, from the fallow,
And the bittern beat his drum
In the evening, from the hollow."

When the bittern is attacked by a bird of prey, it defends itself with great courage, and generally beats off such assailants; neither does it betray any symptoms of fear, when wounded by the sportsman, but eyes him with a keen and undaunted look; and when driven to extremity, will attack him with the utmost vigour, wounding his legs, or aiming at his eyes with his sharp and piercing bill.

Mr. Markwick once shot a bittern in frosty weather; it fell on the ice, which was just strong enough to support the dogs, and they immediately rushed forward to attack it; but being only wounded, it defended itself so vigorously, that the dogs were compelled to leave it, till it was fired at a second time and killed. The bittern is still valued on account of its fine flavour, and is usually sold in the London market at half-a-guinea. It was formerly held in much estimation at the tables of the great.

The cry of the bittern is often heard at twilight in the mountain hollows of Scotland, and has a dreary effect. The following sonnet refers to it in these localities:—

"Now while night's dancing lamps the waste illumine,
And a rich silence bindeth earth and sky,
I hear thy deep and long-repeated cry
Break through the dimness, with a sudden boom,
From some reed-circled lonely pool, whereon
None gazeth save the pale-eyed stars and thee,
What time thou sit'st in moveless reverie
When all the voices of the day are gone.
Rest thee once more, unmindful of the tread
Of one who loves like thee this silent scene
For its wide silence! seek thine ancient bed,
There come no saddening dreams of what hath been.
Thou'rt on the wing, and chilly-fingered fear
Holds my best reason as if ill were near."

CHAP. VII.

OF THE SPOONBILL, OR SHOVELER.

As we proceed in our description of the crane kind, birds of peculiar forms offer, not entirely like the crane, and yet not so far different as to rank more properly with any other class. Where the long neck and stilt-legs of the crane are found, they make too striking a resemblance not to admit such birds of the number; and though the bill, or even the toes, should entirely differ, yet the outlines of the figure, and the natural habits and dispositions, being the same, these are sufficient to mark their place in the general group of nature.

The spoonbill is one of those birds which differs a good deal from the crane, yet approaches this class more than any other. The body is more bulky for its height, and the bill is very differently formed from that of any other bird whatever. Yet still it is a comparatively tall bird; it feeds among waters; its toes are divided; and it seems to possess the natural dis-

positions of the crane. The European spoonbill is of about the bulk of a crane: but as the one is above four feet high, the other is not more than three feet three inches. The common colour of those of Europe is a dirty white; but those of America are of a beautiful rose colour, or a delightful crimson. Beauty of plumage seems to be the prerogative of all the birds of that continent; and we here see the most splendid tints bestowed on a bird, whose figure is sufficient to destroy the effects of its colouring; for its bill is so oddly fashioned, and its eyes so stupidly staring, that its fine feathers only tend to add splendour to deformity. The bill, which in this bird is so very particular, is about seven inches long, and running out broad at the end, as its name justly serves to denote; it is there about an inch and a half wide. This strangely fashioned instrument in some is black; in others of a light gray; and in those of America, it is of a red colour, like the rest of the body. All round the upper chap there runs a kind of rim, with which it covers that beneath; and as for the rest, its cheeks and its throat are without feathers, and covered with a black skin.

A bird so oddly fashioned might be expected to possess some very peculiar appetites; but the spoonbill seems to lead a life entirely resembling all those of the crane kind; and Nature, when she made the bill of this bird so very broad, seems rather to have sported with its form, than to aim at any final cause for which to adapt it. In fact, it is but a poor philosophy to ascribe every capricious variety in nature to some salutary purpose: in such solutions we only impose upon each other, and often wilfully contradict our own belief. There must be imperfections in every being, as well as capacities of enjoyment. Between both, the animal leads a life of moderate felicity; in part making use of its many natural advantages, and in part necessarily conforming to the imperfections of its figure.

The shoveler chiefly feeds upon frogs, toads, and serpents; of which, particularly at the Cape of Good Hope, they destroy great numbers. The inhabitants of that country hold them in as much esteem as the ancient Egyptians did their bird ibis: the shoveler runs tame about their houses; and they are content with its society, as a useful though a homely companion. They are never killed; and, indeed, they are good for nothing when they are dead, for the flesh is unfit to be eaten.

This bird breeds, in Europe, in company with the heron, in high trees; and in a nest formed of the same materials. Willoughby tells us, that in a certain grove, at a village called Seven Huys, near Leyden, they build and breed yearly in great numbers. In this grove, also, the heron, the bittern, the cormorant, and the shag, have taken up their residence, and annually bring forth their young together. Here the crane kind seem to have formed their general rendezvous; and, as

the inhabitants say, every sort of bird has its several quarter, where none but their own tribe are permitted to reside. Of this grove, the peasants of the country make good profit. When the young ones are ripe, those that farm the grove, with a hook at the end of a long pole, catch hold of the bough on which the nest is built, and shake out the young ones; but sometimes the nest and all tumble down together.

The shoveler lays from three to five eggs, white, and powdered with a few sanguine or pale spots. We sometimes see, in the cabinets of the curious, the bills of American shovelers, twice as big and as long as those of the common kind among us; but these birds have not yet made their way into Europe.

SUPPLEMENTARY NOTE.

The spoonbills are voyaging birds, not very wild, and show no aversion to living in a state of captivity. They are found in almost all countries of the old world. In Europe they are seen but seldom in the anterior parts, and are only passagery on some lakes or the banks of rivers. They frequent the marshy coasts of Holland, of Brittany, and of Picardy. They are also seen in Prussia, in Silesia, and in Poland, and in summer they advance as far as West Bothnia and Lapland. They are again to be found on the coasts of Africa, in Egypt, and at the Cape of Good Hope, where they are called *Slangen-wreeter*, that is, Serpent-eaters. Commerson has seen them at Madagascar, where the islanders give them the name of *Fungui-am-bava*, which means spade-bill. The negroes in some districts call them *Vang-van*, and in others *Vourou Doulou*, or 'birds of the devil.'

The *White spoonbill* is an occasional, but rare visitor of this country. They rise very high, and fly in waving lines. Their flesh is tolerably good eating, and is destitute of the oily taste which is peculiar to most shore birds.

The *Roseate spoonbill* is an American species, and is the *Ajaja* of Brazil (Marcgrave), and the *Tlahuquecul* of Fernandez, and *Guirapita* of the natives of Paraguay. Its dimensions are not so great as those of the spoonbill of the ancient continent. The plumage, in general, is of a beautiful rose-colour, while the upper part of the wing and the tail-coverts are of a lively-red. Age, however, operates the same changes of colour in these spoonbills, as in the red curlew, and in the flamingo, which in their first years are almost completely white or gray. The bill and its membrane are of a yellowish-green, which becomes white when the bird is terrified.

The spoonbills usually frequent wooded marshes near the mouths of rivers, building in preference upon the taller trees, but where these are wanting, taking up their abode among the bushes or even among the reeds. The females usually lay three or four whitish eggs. They associate together, but not in any considerable numbers, and feed upon the smaller fishes and their spawn, shell-fish, reptiles, and other aquatic or amphibious animals. The form and flexibility of their bills are well-adapted for burrowing in the mud after their prey; and the tubercles which are placed on the inside of their mandibles serve both to retain the more slippery animals and to break down their shelly coverings. Their internal conformation, which is in nearly every respect similar to that of the stork, is admirably suited to this kind of food. They have no proper voice, the lower larynx being destitute of the muscles by which sounds are produced, and their only means of vocal expression consist in the snapping

of their mandibles, which they clatter with much precipitation when under the influence of anger or alarm. In captivity they are perfectly tame, living in peace and concord with the other inhabitants of the farm-yard, and rarely exhibiting any symptoms of wildness or desire of change. They feed on all kinds of garbage.

CHAP. VIII.

THE FLAMINGO.

THE Flamingo has the justest right to be placed among cranes; and though it happens to be web-footed, like birds of the goose kind, yet its height, figure, and appetites, entirely remove it from that grovelling class of animals. With a longer neck and legs than any other of the crane kind, it seeks its food by wading among waters, and only differs from all of this tribe in the manner of seizing its prey; for as the heron makes use of its claws, the flamingo uses only its bill, which is strong and thick for the purpose, the claws being useless, as they are feeble, and webbed like those of water-fowl.

The flamingo is the most remarkable of all the crane kind, the tallest, the bulkiest, and the most beautiful. The body, which is of a beautiful scarlet, is no bigger than that of a swan; but its legs and neck are of such an extraordinary length, that, when it stands erect, it is six feet six inches high. Its wings, extended, are five feet six inches from tip to tip; and it is four feet eight inches from tip to tail. The head is round and small, with a large bill, seven inches long, partly red, partly black, and crooked like a bow. The legs and thighs, which are not much thicker than a man's finger, are about two feet eight inches high; and its neck near three feet long. The feet are not furnished with sharp claws, as in others of the crane kind; but feeble, and united by membranes, as in those of the goose. Of what use these membranes are does not appear, as the bird is never seen swimming, its legs and thighs being sufficient for bearing it into those depths where it seeks for prey.

This extraordinary bird is now chiefly found in America; but it was once known on all the coasts of Europe. Its beauty, its size, and the peculiar delicacy of its flesh, have been such temptations to destroy or take it, that it has long since deserted the shores frequented by man, and taken refuge in countries that are as yet but thinly peopled. In those desert regions, the flamingoes live in a state of society, and under a better polity than any other of the feathered creation.

When the Europeans first came to America, and coasted down along the African shores, they found the flamingoes on several shores on either continent, gentle, and no way distrustful of man-

kind.¹ They had long been used to security, in the extensive solitudes they had chosen; and knew no enemies but those they could very well evade or oppose. The Negroes and the native Americans were possessed but of few destructive arts for killing them at a distance; and when the bird perceived the arrow, it well knew how to avoid it. But it was otherwise when the Europeans first came among them; the sailors, not considering that the dread of fire-arms was totally unknown in that part of the world, gave the flamingo the character of a foolish bird, that suffered itself to be approached and shot at. When the fowler had killed one, the rest of the flock, far from attempting to fly, only regarded the fall of their companion in a kind of fixed astonishment; another and another shot was discharged; and thus the fowler often levelled the whole flock, before one of them began to think of escaping.

But at present it is very different in that part of the world; and the flamingo is not only one of the scarcest, but of the shyest birds in the world, and the most difficult of approach. They chiefly keep near the most deserted and inhospitable shores; near salt-water lakes and swampy islands. They come down to the banks of rivers by day; and often retire to the inland mountainous parts of the country at the approach of night. When seen by mariners in the day, they always appear drawn up in a long close line of two or three hundred together; and, as Dampier tells us, present at the distance of half a mile, the exact representation of a long brick wall. Their rank, however, is broken when they seek for food; but they always appoint one of the number as a watch, whose only employment is to observe and give notice of danger, while the rest are feeding. As soon as this trusty sentinel perceives the remotest appearance of danger, he gives a loud scream, with a voice as shrill as a trumpet, and instantly the whole cohort are upon the wing. They feed in silence; but upon this occasion, all the flock are in one chorus, and fill the air with intolerable screamings.

From this it appears, that the flamingoes are very difficult to be approached at present, and that they avoid mankind with the most cautious timidity; however, it is not from any antipathy to man that they shun his society, for in some villages, as we are assured by Labat, along the coasts of Africa, the flamingoes come in great numbers to make their residence among the natives. There they assemble by thousands, perched on the trees, within and about the village; and are so very clamorous, that the sound is heard at near a mile's distance. The Negroes are fond of their company; and consider their society as a gift of Heaven, as a protection from accidental evils. The French, who are admitted to this part of the coast, cannot, without some degree

¹ Albin's New History of Birds.

of discontent, see such a quantity of game untouched, and rendered useless by the superstition of the natives: they now and then privately shoot some of them, when at a convenient distance from the village, and hide them in the long grass, if they perceive any of the Negroes approaching; for they would probably stand a chance of being ill used, if the blacks discovered their sacred birds were thus unmercifully treated.

Sometimes, in their wild state, they are shot by mariners, and their young, which run excessively fast, are often taken. Labat has frequently taken them with nets, properly extended round the places they breed in. When their long legs are entangled in the meshes, they are then unqualified to make their escape: but they still continue to combat with their destroyer; and the old ones, though seized by the head, will scratch with their claws; and these, though seemingly inoffensive, very often do mischief. When they are fairly disengaged from the net, they nevertheless preserve their natural ferocity: they refuse all nourishment; they peck, and combat with their claws, at every opportunity. The fowler is, therefore, under a necessity of destroying them, when taken; as they would only pine and die, if left to themselves in captivity.

The flesh of the old ones is black and hard; though, Dampier says, well-tasted: that of the young ones is still better. But of all other delicacies, the flamingo's tongue is the most celebrated. "A dish of flamingoes' tongues," says our author, "is a feast for an emperor." In fact, the Roman emperors considered them as the highest luxury; and we have an account of one of them, who procured fifteen hundred flamingoes' tongues to be served up in a single dish. The tongue of this bird, which is so much sought after, is a good deal larger than that of any other bird whatever. The bill of the flamingo is like a large black box, of an irregular figure, and filled with a tongue which is black and gristly; but what peculiar flavour it may possess, I leave to be determined by such as understand good eating better than I do. It is probable, that the beauty and scarcity of the bird might be the first inducements to studious gluttony to fix upon its tongue as meat for the table. What Dampier says of the goodness of its flesh cannot so well be relied on; for Dampier was often hungry, and thought any thing good that could be eaten: he avers, indeed, with Labat, that the flesh is black, tough, and fishy; so that we can hardly give him credit, when he asserts, that its flesh can be formed into a luxurious entertainment.

These birds, as was said, always go in flocks together; and they move in rank in the manner of cranes. They are sometimes seen at the break of day, flying down in great numbers from the mountains, and conducting each other with a trumpet cry, that sounds like the word *Toc co*, from whence the savages of Canada have given

them the name. In their flight they appear to great advantage; for they then seem of as bright a red as a burning coal. When they dispose themselves to feed, their cry ceases; and then they disperse over a whole marsh, in silence and assiduity. Their manner of feeding is very singular: the bird thrusts down its head, so that the upper convex side of the bill shall only touch the ground; and in this position the animal appears, as it were, standing upon its head. In this manner it paddles and moves the bill about, and seizes whatever fish or insect happens to offer. For this purpose the upper chap is notched at the edges, so as to hold its prey with the greater security. Catesby, however, gives a different account of their feeding. According to him, they thus place the upper chap undermost, and so work about, in order to peck up a seed from the bottom of the water, that resembles millet: but as in pecking up this they necessarily also suck in a great quantity of mud, their bill is toothed at the edges in such a manner as to let out the mud while they swallow the grain.

Their time of breeding is according to the climate in which they reside; in North America they breed in our summer; on the other side of the line, they take the most favourable season of the year. They build their nests in extensive marshes, and where they are in no danger of a surprise. The nest is not less curious than the animal that builds it: it is raised from the surface of the pool about a foot and a half, formed of mud scraped up together, and hardened by the sun, or the heat of the bird's body; it resembles a truncated cone, or one of the pots which we see placed in chimneys; on the top it is hollowed out to the shape of the bird, and in that cavity the female lays her eggs, without any lining but the well-cemented mud that forms the sides of the building. She always lays two eggs, and no more; and, as her legs are immoderately long, she straddles on the nest, while her legs hang down one on each side, into the water.

The young ones are a long while before they are able to fly; but they run with amazing swiftness. They are sometimes caught; and, very different from the old ones, suffer themselves to be carried home, and are tamed very easily. In five or six days they become familiar, eat out of the hand, and drink a surprising quantity of seawater. But though they are easily rendered domestic, they are not reared without the greatest difficulty: for they generally pine away, for want of their natural supplies, and die in a short time. While they are yet young, their colours are very different from those lively tints which they acquire with age. In their first year they are covered with plumage of a white colour, mixed with gray: in the second year the whole body is white, with here and there a slight tint of scarlet; and the great covert feathers of the wings are black; the third year the bird acquires all its beauty;

the plumage of the whole body is scarlet, except some of the feathers in the wings, that still retain their sable hue. Of these beautiful plumes the savages make various ornaments; and the bird is sometimes skinned by the Europeans to make muffs. But these have diminished in their price, since we have obtained the art of dyeing feathers of the brightest scarlet.

CHAP. IX.

THE AVOSETTA OR SCOOPER; AND THE CORRIRA OR RUNNER.

THE extraordinary shape of the Avosetta's bill might incline us to wish for its history; and yet in that we are not able to indulge the reader. Natural historians have hitherto, like ambitious monarchs, shown a greater fondness for extending their dominions, than cultivating what they possess. While they have been labouring to add new varieties to their catalogues, they have neglected to study the history of animals already known.

The avosetta is chiefly found in Italy, and now and then comes over into England. It is about the size of a pigeon, is a pretty upright bird, and has extremely long legs for its size. But the most extraordinary part of its figure, and that by which it may be distinguished from all others of the feathered tribe, is the bill, which turns up like a hook, in an opposite direction to that of the hawk or the parrot. This extraordinary bill is black, flat, sharp, and flexible at the end, and about three inches and a half long. From its being bare a long way above the knee, it appears that it lives and wades in the waters. It has a chirping pert note, as we are told; but with its other habits we are entirely unacquainted. I have placed it, from its slender figure, among the cranes; although it is web-footed, like the duck. It is one of those birds of whose history we are yet in expectation.¹

¹ The avosets of Europe and America prefer cold and temperate climates to hot countries. Their migrations are determined by the want or abundance of food. In winter they assemble in small flocks of six or seven; and frequent our shores, especially the mouths of large muddy rivers, in search of worms and marine insects. These they scoop out of the mud with their recurved bills, which are admirably adapted for that purpose, being tough and flexible like whalebone. The feet seem calculated for swimming, but they are never observed to take the water: it is therefore probable, that they are furnished with a web merely to prevent their sinking into the mud. The female lays two eggs, about the size of those of a pigeon, of a white colour tinged with green, and marked with large black spots. It is said to be very tenacious of its young, and when disturbed at this season will fly round in repeated circles, uttering a note that resembles the word *twit-twit*. This bird breeds in the fens of Lincolnshire, and in Romney marsh in Kent. It is found in Britain at all seasons.

To this bird of the crane kind, so little known, I will add another, still less known; the Corriira, or Runner, of Aldrovandus. All we are told of it is, that it has the longest legs of all web-footed fowls, except the flamingo and avosetta; that the bill is straight, yellow, and black at the ends; that the pupils of the eyes are surrounded with two circles, one of which is bay, and the other white: below, near the belly, it is whitish; the tail, with two white feathers, black at the extremities: and that the upper part of the body is of the colour of rusty iron. It is thus that we are obliged to substitute dry description for instructive history; and employ words to express those shadings of colour which the pencil alone can convey.

CHAP. X.

OF SMALL BIRDS OF THE CRANE KIND, WITH THE THIGHS PARTLY BARE OF FEATHERS.

As I have taken my distinctions rather from the general form and manners of birds, than from their minuter though perhaps more precise discriminations, it will not be expected that I should here enter into a particular history of a numerous tribe of birds, whose manners and forms are so very much alike. Of many of them we have scarcely any account in our historians, but tedious descriptions of their dimensions, and the colour of their plumage; and of the rest, the history of one is so much that of all, that it is but the same account repeated to a most disgusting reiteration. I will therefore group them into one general draught; in which the more eminent, or the most whimsical, will naturally stand forward on the canvass.

In this group we find an extensive tribe of native birds, with their varieties and affinities; and we might add a hundred others, of distant climates, of which we know little more than the colour and the name. In this list is exhibited the Curlew, a bird of about the size of a duck, with a bill four inches long: the Woodcock, about the size of a pigeon, with a bill three inches long: the Godwit, of the same size; the bill four inches: the Green Shank, longer legged; the bill two inches and a half: the Red Shank, differing in the colour of its feet from the former: the Snipe, less by half, with a bill three inches. Then with shorter bills—The Ruff, with a collar of feathers round the neck of the male; the Knot, the Sandpiper, the Sanderling, the Dunlin, the Purge, and the Stint. To conclude; with bills very short—The Lapwing, the Green

In winter it frequents the sea-shore. It is widely diffused on the continent, inhabiting Denmark, Sweden, Russia, Siberia, and the Caspian sea, and more plentifully on the salt lakes in the deserts of Tartary. —ED.

Plover, the Gray Plover, the Dottrel, the Turnstone, and the Sea-lark. These, with their affinities, are properly natives or visitants of this country; and are dispersed along our shores, rivers, and watery grounds. Taking in the birds of this kind, belonging to other countries, the list would be very widely extended; and the whole of this class, as described by Brisson, would amount to near an hundred.

All these birds possess many marks in common; though some have peculiarities that deserve regard. All these birds are bare of feathers above the knee, or above the heel, as some naturalists choose to express it. In fact, that part which I call the knee, if compared with the legs of mankind, is analogous to the heel; but as it is commonly conceived otherwise, I have conformed to the general apprehension. I say, therefore, that all these birds are bare of feathers above the knee; and in some they are wanting half way up the thigh. The nudity in that part is partly natural, and partly produced by all birds of this kind habitually wading in water. The older the bird, the barer are its thighs; yet even the young ones have not the same downy covering reaching so low as the birds of any other class. Such a covering there would rather be prejudicial, as being continually liable to get wet in the water.

As these birds are usually employed rather in running than in flying, and as their food lies entirely upon the ground, and not on trees or in the air, so they run with great swiftness for their size, and the length of their legs assists their velocity. But, as in seeking their food they are often obliged to change their station; so also are they equally swift of wing, and traverse immense tracts of country without much fatigue.

It has been thought by some, that a part of this class lived upon an oily slime, found in the bottoms of ditches and of weedy pools; they were thence termed, by Willoughby, *Mudsuckers*. But later discoveries have shown that, in these places, they hunt for the caterpillars and worms of insects. From hence, therefore, we may generally assert, that all birds of this class live upon animals of one kind or another. The long-billed birds suck up worms and insects from the bottom; those furnished with shorter bills, pick up such insects as lie nearer the surface of the meadow, or among the sands on the sea-shore.

Thus the curlew, the woodcock, and the snipe, are ever seen in plashy brakes, and under covered hedges, assiduously employed in seeking out insects in their worm state; and it seems, from their fatness, that they find a plentiful supply. Nature, indeed, has furnished them with very convenient instruments for procuring their food. Their bills are made sufficiently long for searching; but still more, they are endowed with an exquisite sensibility at the point, for feeling their provision. They are furnished with no less than three pair of nerves, equal almost to the optic

nerves in thickness; which pass from the roof of the mouth, and run along the upper chap to the point.

Nor are those birds with shorter bills, and destitute of such convenient instruments, without a proper provision made for their subsistence. The lapwing, the sandpiper, and the redshank, run with surprising rapidity along the surface of the marsh or the sea-shore, quarter their ground with great dexterity, and leave nothing of the insect kind that happens to lie on the surface. These, however, are neither so fat nor so delicate as the former; as they are obliged to toil more for a subsistence, they are easily satisfied with whatever offers; and their flesh often contracts a relish of what has been their latest, or their principal food.

Most of the birds formerly described have stated times for feeding and rest: the eagle kind prowl by day, and at evening repose; the owl by night, and keeps unseen in the daytime: but these birds, of the crane kind, seem at all hours employed; they are seldom at rest by day; and during the whole night-season, every meadow and marsh resounds with their different calls, to courtship or to food.

This seems to be the time when they least fear interruption from man; and though they fly at all times, yet at this season they appear more assiduously employed, both in providing for their present support, and continuing that of posterity. This is usually the season when the insidious fowler steals in upon their occupations, and fills the whole meadow with terror and destruction.

As all of this kind live entirely in waters, and among watery places, they seem provided by nature with a warmth of constitution to fit them for that cold element. They reside, by choice, in the coldest climates; and as other birds migrate here in our summer, their migrations hither are mostly in the winter. Even those that reside among us the whole season, retire in summer to the tops of our bleakest mountains; where they breed, and bring down their young when the cold weather sets in.

Most of them, however, migrate, and retire to the polar regions; as those that remain behind in the mountains, and keep with us during summer, bear no proportion to the quantity which in winter haunt our marshes and low grounds. The snipe sometimes builds here; and the nest of the curlew is sometimes found in the plashes of our hills; but the number of these is very small; and it is most probable that they are only some stragglers who, not having strength or courage sufficient for the general voyage, take up from necessity their habitation here.

In general, during the summer, this whole class either choose the coldest countries to retire to, or the coldest and the moistest part of ours to breed in. The curlew, the woodcock, the snipe, the godwit, the gray plover, the green and

the long-legged plover, the knot, and the turnstone, are rather the guests than the natives of this island. They visit us in the beginning of winter, and forsake us in the spring. They then retire to the mountains of Sweden, Poland, Prussia, and Lapland, to breed. Our country, during the summer season, becomes uninhabitable to them. The ground parched up by the heat, the springs dried away, and the vermicular insects already upon the wing, they have no means of subsisting. Their weak and delicately pointed bills are unfit to dig into a resisting soil; and their prey is departed, though they were able to reach its retreats. Thus, that season when Nature is said to teem with life, and to put on her gayest liveries, is to them an interval of sterility and famine. The coldest mountains of the north are then a preferable habitation; the marshes there are never totally dried up; and the insects are in such abundance, that both above ground and underneath, the country swarms with them. In such retreats, therefore, these birds would continue always; but that the frosts, when they set in, have the same effect upon the face of the landscape as the heats of summer. Every brook is stiffened into ice; all the earth is congealed into one solid mass; and the birds are obliged to forsake a region where they can no longer find subsistence.

Such are our visitants. With regard to those which keep with us continually, and breed here, they are neither so delicate in their food, nor perhaps so warm in their constitutions. The lapwing, the ruff, the redshank, the sandpiper, the sea-pie, the Norfolk plover, and the sea-lark, breed in this country, and for the most part reside here. In summer they frequent such marshes as are not dried up in any part of the year; the Essex hundreds, and the fens of Lincolnshire. There, in solitudes formed by surrounding marshes, they breed and bring up their young. In winter they come down from their retreats rendered uninhabitable by the flooding of the waters, and seek their food about our ditches and marshy meadow-grounds. Yet, even of this class, all are wanderers upon some occasions; and take wing to the northern climates, to breed and find subsistence. This happens when our summers are peculiarly dry; and when the fenny countries are not sufficiently watered to defend their retreats.

But though this be the usual course of nature, with respect to these birds, they often break through the general habits of their kind; and as the lapwing, the ruff, and the sandpiper, are sometimes seen to alter their manners, and to migrate from hence, instead of continuing to breed here; so we often find the woodcock, the snipe, and the curlew, reside with us during the whole season, and breed their young in different parts of the country. In Casewood, about two miles from Tunbridge, as Mr. Pennant assures us, some woodcocks are seen to breed annually.

The young have been shot there in the beginning of August; and were as healthy and vigorous as they are with us in winter, though not so well tasted. On the Alps, and other high mountains, says Willoughby, the woodcock continues all summer; I myself have flushed them on the top of mount Jura, in June and July. The eggs are long, of a pale red colour, and stained with deeper spots and clouds. The nests of the curlew and the snipe are frequently found; and some of these perhaps never entirely leave this island.

It is thus that the same habits are, in some measure, common to all; but in nestling, and bringing up their young, one method takes place universally. As they all run and feed upon the ground, so they are all found to nestle there. The number of eggs generally to be seen in every nest is from two to four; never under, and very seldom exceeding. The nest is made without any art; but the eggs are either laid in some little depression of the earth, or on a few bents and long grass, that scarcely preserve them from the moisture below. Yet such is the heat of the body of these birds, that the time of incubation is shorter than with any other of the same size. The magpie, for instance, takes twenty-one days to hatch its young; the lapwing takes but fourteen. Whether the animal oil, with which these birds abound, gives them this superior warmth, I cannot tell; but there is no doubt of their quick incubation.

In their seasons of courtship they pair as other birds; but not without violent contests between the males, for the choice of the female. The lapwing and the plover are often seen to fight among themselves; but there is one little bird of this tribe, called the *ruff*, that has got the epithet of the *fighter*, merely from its great perseverance and animosity on these occasions. In the beginning of spring, when these birds arrive among our marshes, they are observed to engage with desperate fury against each other: it is then that the fowlers, seeing them intent on mutual destruction, spread their nets over them, and take them in great numbers. Yet even in captivity their animosity still continues: the people that fat them up for sale are obliged to shut them up in close dark rooms; for if they let ever so little light in among them, the turbulent prisoners instantly fall to fighting with each other, and never cease till each has killed its antagonist, especially, says Willoughby, if anybody stands by. A similar animosity, though in a less degree, prompts all this tribe; but when they have paired, and begun to lay, their contentions are then over.

The place these birds chiefly choose to breed in, is in some island surrounded with sedgy moors, where men seldom resort; and in such situations I have often seen the ground so strewn with eggs and nests, that one could scarcely take a step without treading upon some of them.

As soon as a stranger intrudes upon these retreats, the whole colony is up, and a hundred different screams are heard from every quarter. The arts of the lapwing, to allure men or dogs from her nest, are perfectly amusing. When she perceives the enemy approaching, she never waits till they arrive at her nest, but boldly runs to meet them: when she has come as near them as she dares to venture, she then rises with a loud screaming before them, seeming as if she were just flushed from hatching; while she is then probably a hundred yards from the nest. Thus she flies with great clamour and anxiety, whining and screaming around the invaders, striking at them with her wings, and fluttering as if she were wounded. To add to the deceit, she appears still more clamorous as more remote from the nest. If she sees them very near, she then seems to be quite unconcerned, and her cries cease, while her terrors are really augmenting. If there be dogs, she flies heavily at a little distance before them, as if maimed; still vociferous and still bold, but never offering to move towards the quarter where her treasure is deposited. The dog pursues, in hopes every moment of seizing the parent, and by this means actually loses the young; for the cunning bird, when she has thus drawn him off to a proper distance, then puts forth her powers, and leaves her astonished pursuers to gaze at the rapidity of her flight. The eggs of all these birds are highly valued by the luxurious; they are boiled hard, and thus served up without any further preparation.

As the young of this class are soon hatched, so, when excluded, they quickly arrive at maturity. They run about after the mother as soon as they leave the egg; and being covered with a thick down, want very little of that clutching which all birds of the poultry kind, that follow the mother, indispensably require. They come to their adult state long before winter; and then flock together till the breeding season returns, which for a while dissolves their society.

As the flesh of almost all these birds is in high estimation, so many methods have been contrived for taking them. That used in taking the ruff seems to be most advantageous; and it may not be amiss to describe it. The ruff—which is the name of the male, the reeve that of the female—is taken in nets about forty yards long, and seven or eight feet high. These birds are chiefly found in Lincolnshire and the Isle of Ely, where they come about the latter end of April, and disappear about Michaelmas. The male of this bird, which is known from all others of the kind by the great length of the feathers round his neck, is yet so various in his plumage, that it is said no two ruffs were ever seen totally of the same colour. The nets in which these are taken are supported by sticks, at an angle of near forty-five degrees, and placed either on dry ground, or in very shallow water, not remote from reeds:

among these the fowler conceals himself, till the birds, enticed by a stale or stuffed bird, come under the nets; he then, by pulling a string, lets them fall, and they are taken; as are god-wits, knots, and gray plover, also, in the same manner. When these birds are brought from under the net, they are not killed immediately, but fattened for the table, with bread and milk, hempseed, and sometimes boiled wheat; but if expedition is wanted, sugar is added, which will make them a lump of fat in a fortnight's time. They are kept, as observed before, in a dark room; and judgment is required in taking the proper time for killing them, when they are at the highest pitch of fatness: for if that is neglected, the birds are apt to fall away. They are reckoned a very great delicacy; they sell for two shillings, or half-a-crown, a-piece; and are served up to the table with the train, like woodcocks, where we will leave them.

SUPPLEMENTARY NOTE.

We shall here notice more particularly the birds enumerated in the above chapter.

The *Curlew*.—There are two species of the curlew to be found in Europe—the Common curlew and the Little curlew; but there are various other species, in Asia, Africa, and America, differing very much in size, the longest measuring about twenty-five inches, and sometimes weighing thirty-six ounces. The following pleasing paper on the habits of the curlew and some of its congeners, is from the pen of that able ornithologist, Professor Macgillivray of Aberdeen: “With the history of the curlew might be connected, and not inappropriately, much of the wild scenery of our land, for, during the breeding season, its retreats are the barren heath and the mountain side. Let it now be the middle of October. We are traversing the mud flat that extends from the village of Cramond to near Queensferry, on the southern shore of the frith of Forth. Many gulls are scattered over the sands,—small flocks of ducks are swimming in the river,—straggling bands of terns hover and scream along the edge of the water,—here and there may be seen a solitary gannet gliding past,—and far out at sea are some dusky birds, which may be cormorants or red-throated divers. On that shoal is a vast assemblage of small birds, probably dunlins; farther on are some black and white waders, which we may conjecture to be oyster-catchers; and here, scattered over the miry flat, are very many gray-backed, long-legged, long-necked, and long-billed stragglers, the very birds of which we are in search. They observe us, one utters a loud shrill cry, to which another responds, and presently all are on the wing. Mark how they fly, at a moderate height, with contracted neck, outstretched bill, feet folded back, wide-spread wings, moved in regular time. Away they speed, one screaming now and then, and alarming the gulls and other birds in their course; nor do they stop until, arriving at a suitable spot a quarter of a mile off, they perform a few circling evolutions, and alight by the margin of the sea, into which some of them wade, while the rest disperse over the sand. All that we can see or say of them here is, that at this season they have arrived on the sea-shore, where they frequent the beaches, searching for food in the same way as the godwits, long-shanks, and sandpipers, but in what precise manner they procure it, or of what it consists, remains to be discovered. To see these vigilant and suspicious birds at hand, we must find some place resorted to

by them, in which we may draw near without being perceived. Let us then betake ourselves to the island of Harris.

Here is a low tract of sandy pasture, with a shallow pool upon it, and extending along a large ford or expanse of sand, covered by the tide and laid bare when it recedes. Many curlews and golden plovers, a few ringed dotterels, two or three mallards, and, doubtless, hundreds of snipes, are dispersed over the plashy ground. That old turf cattle-fold will enable us to approach the birds unseen, unless some of the curlews should happen to fly overhead and discover us, when they will be sure to sound an alarm. Now crawl this way, and see that the muzzle of your gun is not filled with sand. From this slap in the wall, cautiously raising our heads until we can bring an eye to bear on them, we may observe their motions. There, twenty paces off, stalks an old curlew, cunning and sagacious, yet not aware of our proximity. He has heard, or fancied that he has heard, some unusual sound, and there he moves slowly, with raised head, and ear attent; but some appearance in the soft sand has attracted his notice, and, forgetting his fears, he thrusts, or rather works his bill into it, and, extracting something which he swallows, withdraws it, and proceeds, looking carefully around. Now from the surface he picks up a snail, of that small kind named *Helix ericetorum*, which, raising his head, and moving it rapidly backwards and forwards, at the same time slightly opening and closing his mandibles, he gradually brings within reach of his tongue, when he swallows it. There he has dragged a worm from the sand, and again has obtained a small crab or insect. But now two others have come up; they are within range; let me fire. There they lie, two dead; the other, with broken wing, runs off loudly screaming. Curlews, plovers, redshanks, dotterels, ducks, and snipes, all rise, and move to a distance corresponding to their fears, the curlews flying out of sight, the snipes coming back to the same spot, and the plovers alighting about two hundred yards off.

The curlew is extremely shy and suspicious, so that at this season, unless by some stratagem or accident, one can very seldom obtain a shot at it. In Harris I once shot three from a fold in the manner described above. On another occasion, having a musket with large shot, I let fly at one feeding in a field as I was passing along, hit it in the wing, and on measuring the distance found it to be seventy-five yards. In the Hebrides it is a common saying, that to kill seven curlews is enough for a lifetime; but one, by lying among the rocks on a point frequented by them, might, I doubt not, shoot as many in less than a week. This method, however, I have never tried, it being much more pleasant to be moving about than lying jammed into the crevice of a cliff. When alarmed, they spread out their wings, run rapidly forward some paces, and, springing into the air, uttering their loud cries, fly off at a rapid rate. When looking for food, they generally walk sedately, unlike the redshank, which is continually running, stooping, or vibrating, but sometimes run, and that with great celerity. Dry pastures, moist grounds, and shallow pools, are equally frequented by them, and they may be seen wading in the water up to the tarsal joint. Towards the end of March they generally leave the shores, where they have resided in flocks from September, and separating in pairs, betake themselves to the interior, where, in the higher and less frequented moors, they deposit their eggs, and rear their young. It is now the beginning of May. The sunny banks are covered with primroses, the golden catkins of the willow fringe the brooks, while the spikes of the cotton-grass ornament the moss-clad moor. Let us ascend the long glen, and, wandering on the heathy slopes, listen to

the clear but melancholy whistle of the plover, the bleating of the snipe, and the loud scream of the curlew. Here is a bog, interspersed with tufts of heath, among which is a profusion of *Myrica Gale*. Some lapwings are coming up, gliding and flapping their long broad wings; a black-breasted plover has stationed himself on the top of that mound of green moss, and a ring ouzel has just sprung from the furze on the brae. See, what is that? A hare has sprung from among our feet! No, a curlew fluttering along the ground, wounded, unable to escape. Run! She has been sitting; here is the nest in a hollow under shelter of two tufts of heath and a stunted willow. It is composed of dry grass, apparently *Eriophora*, *Eleocharis palustris*, *Scirpus caespitosus*, some twigs of heath, and, perhaps, portions of other plants not very neatly disposed. It is very shallow, and internally about a foot in diameter. The eggs are four, pyriform, excessively large, three inches long, an inch and ten-twelfths across, light olive or dull yellowish-brown, or pale greenish-gray, blotched and spotted with umber brown, the markings crowded on the larger end. They vary considerably in size and form, some being only two inches and three-quarters in length. Those in the nest before us are of the largest size, very darkly coloured, and so little contrasting with the surrounding objects, that unless the bird had sprung up among our feet, we should scarcely have observed them. Far up on the hill-side you hear the loud cry of the curlew, which is presently responded to from the opposite slope; in another place a bird commences a series of modulated cries, and, springing up, performs a curved flight, flapping its wings and screaming as it proceeds. Presently the whole glen is vocal, but not with sweet sounds like those of the mavis and the merle. But it is vain to pursue the birds, for these are the males, and at this season you will find them fully as shy as they were in winter on the sea-shore. Some weeks hence, when the young are abroad, the females and even the males, will flutter around you if you approach the spot where their unfledged brood lie concealed among the herbage, and will attempt, by feigning distress, to lead you into a vain pursuit.

Like all the other birds of this genus, the young are covered with long, stiffish down, and run about presently after exclusion from the egg, squatting to conceal themselves from their enemies. Up to the age of three weeks they are still unfeathered; their forehead, throat, and under surface, yellowish-gray, their upper parts of the same colour, with patches of dark brown; the bill not longer than the head. That organ gradually elongates, as the feathers sprout, and by the end of about seven weeks they are able to fly. At this season old and young feed on insects, larvæ, and worms. The latter are very fat, but the former are not in good condition until the middle of autumn, about which period the curlews unite into small flocks, gradually disperse, and betake themselves to the shores. Their flesh is delicate and well-flavoured, and they are not unfrequently to be seen in our markets. I am not aware of any difference produced in the quality of their flesh as an article of food by their change of residence.

Montagu has given, in the Supplement to his 'Ornithological Dictionary,' a very interesting account of a tame bird of this species. 'One which was shot on the wing, was turned amongst aquatic birds, and was at first so extremely shy, that he was obliged to be crammed with meat for a day or two, when he began to eat worms; but as this was precarious food, he was tempted to eat bread and milk like Ruffs. To induce this substitution, worms were put into a mess of bread mixed with milk, and it was curious to observe how cautiously he avoided the mixture, by carrying every worm to the pond, and well washing it previous to swallowing. In the

course of a few days this new diet did not appear unpalatable to him, and in a little more than a week he became partial to it, and, from being exceedingly poor and emaciated, got plump and in high health. In the course of a month or six weeks, this bird became excessively tame, and would follow a person across the menagerie for a bit of bread, or a small fish, of which he was remarkably fond. But he became almost omnivorous; fish, water-lizards, small frogs, insects of every kind that were not too large to swallow, and (in defect of other food) barley with the ducks was not rejected. This very great favourite was at last killed by a rat (as it was suspected), after a short life of two years in confinement; but he had in that time fully satisfied our inquiries into his natural habits.

An adult male curlew measures 25 inches in length, 42 from the tip of one wing to that of the other. The body is ovate and rather full, the legs long and slender, the neck also long, the head rather small, the bill extremely long, measuring six inches; the tibia bare at its lower end, the tarsus reticulated, the toes rather short, slender, three before, one behind. The throat is very narrow; the œsophagus very long and rather slender; the proventriculus oblong; the stomach a large and powerful gizzard; the intestine long, of moderate width; the cœca rather slender, cylindrical, $4\frac{1}{2}$ inches long. The plumage is moderately full, soft, and blended; the wings very long, narrow, pointed, the first primary longest; the tail rather short and rounded.

The bill is black, the base of the lower mandible and the basal margins of the upper flesh-coloured. The general colour of the upper parts and neck is light-grayish-yellow tinged with red, each feather with a central blackish-brown streak; the scapulars with serriform yellowish-red spots on the edges; the primaries deep brown, the first five quills unspotted on the outer web, the rest with serriform white spots on the outer, and all with similar large spots on the inner web; the back white, with narrow longitudinal black marks; the upper tail-coverts barred with black; the tail white, with twelve brownish-black bands; the breast, sides, and abdomen, white; the first with lanceolate spots, the second with spots and bars; the last tail-coverts with narrow lanceolate spots.

The Woodcock.—During summer-time the woodcock is an inhabitant of Norway, Sweden, Lapland, and other northern countries, where it breeds. As soon, however, as the frosts commence, it retires southward to milder climates. These birds arrive in Great Britain in flocks; some of them in October, but not in great numbers till November and December. They generally take advantage of the night, being seldom seen to come before sunset. The time of their arrival depends considerably on the prevailing winds; for adverse gales always detain them, they not being able to struggle with the boisterous squalls of the Northern Ocean. After their arrival in bad weather, they have often been seen so much exhausted as to allow themselves to be taken by the hand, when they alighted near the coast. They live on worms and insects, which they search for with their long bills in soft ground and moist woods, feeding and flying principally in the night. They go out in the evening; and generally return in the same direction, through the same galdes, to their day-retreat. The greater part of them leave this country about the latter end of February, or the beginning of March, always pairing before they set out. They retire to the coast, and, if the wind be fair, set out immediately; but if contrary, they are often detained in the neighbouring woods and thickets for some time. In this crisis the sportsmen are all on the alert, and the whole surrounding country echoes to the discharge of guns; seventeen brace

have been killed by one person in a day. But if they are detained long on the dry heaths, they become so lean as to be scarcely eatable. The instant a fair wind springs up, they seize the opportunity; and where the sportsman has seen hundreds in one day, he will not find even a single bird the next. Very few of them breed in England; and perhaps with respect to those that do, it may be owing to their having been wounded by the sportsman in the winter, so as to be disabled from taking their long journey in the spring. They build their nests on the ground, generally at the root of some tree, and lay four or five eggs about the size of those of a pigeon, of a rusty colour, and marked with brown spots. They are remarkably tame during incubation. A person who discovered a woodcock on its nest, often stood over, and even stroked it; notwithstanding it hatched the young ones, and in due time disappeared with them.

We have a very correct account of the migration of the woodcock in the following extract from Warner's 'Tour through Cornwall':—"Before I quit the Lands-end it may be amusing to mention a particular of its natural history, which I think throws some light on the much disputed subject of the migration of English birds. You are aware, perhaps, that a controversy has long subsisted between ornithologists, whether these birds, which are seen amongst us at particular seasons, remain in the kingdom concealed in undiscoverable recesses during the period of their disappearance, or whether they are actually absent from our climate at this time, and resident in countries more congenial to their nature and instincts. In this list of migratory birds, as they are called, the woodcock, that important article of luxury and sport, is enumerated. Mr. Daines Barrington, amongst others, is a strenuous opponent to the doctrine of this species of bird making a periodical passage from England to other countries; contending that it builds its nest, and breeds among us, in the same manner as other indigenous British birds; and is invisible during the summer only from the caution of its habits, and privacy of its retreats, in season. He further makes the assertion with respect to migratory birds in general, that there is no well-attested instance of such migration actually taking place, which he considers as a convincing negative proof of that opinion. What the value of these examples of migration may be, which are adduced by Willoughby, Buffon, Adanson, &c., I know not, as I have never paid any attention to the controversy; but I will venture to assert, that had Mr. Daines Barrington made the question, with respect to woodcocks, a subject of his inquiry when he was in Cornwall, he would have learned a fact at the Lands-end, which must have at once settled scepticism on that particular head. He would here have been told by every peasant and fisherman, that the annual periodical arrival of the woodcocks from the Atlantic, at the close of the year, is as naturally expected, and as surely takes place, as the return of winter and autumn; and that the time of their visit is directed by so certain an instinct, that the inhabitants can tell, by the temperature of the air, the week, if not the day, on which they will arrive. He would have been convinced that migration is the general habit of the species, and not the wayward act of an individual bird, by the prodigious flocks of them which reach the shore at the same time; and no doubt would have remained on his mind of their coming from Asar, when he had been told, that after their arrival, they might, for a day or two, be easily knocked down, or caught by dogs, from the extreme exhaustion induced by their flight. A short respite indeed amongst the bushes and stones of the Lands-end again invigorates them, and enables them to take an inland course; but till they are thus recruited, they are an

easy prey, and produce no mean profit to those who live in the neighbourhood of this place, at their first landing in England. We were told at Truro, as a proof of the definitive time of their arrival, that a gentleman there had sent to the Lands-end for several brace, to be forwarded to him for a particular occasion. His correspondent acquainted him in answer, that no woodcocks had yet arrived; but that on the third day from his writing, if the weather continued as it then was, there would be plenty. The state of the atmosphere remained unchanged, the visitors came as it was asserted they would, and the gentleman received the number of birds he had ordered.—From all these circumstances we conclude, that woodcocks are actually migratory birds, that they retire from England when the temperature of our climate becomes too warm for them, take their flight to more northerly regions, and return to our coast as soon as the cold of these higher latitudes render it unpleasing for them to remain."

The Snipes.—The snipes, though agreeing very much in external resemblance with the woodcocks, differ from them in natural habits. They do not inhabit woods, but remain in the marshy parts of meadows, in the herbage, and amongst the osiers which are on the banks of rivers. They are still more generally spread than the woodcocks, and there are no portions of the globe in which some of them have not been found. They are observed to be incessantly employed in pecking the ground, and Aldrovandus has remarked that they have the tongue terminating in a sharp point, proper for piercing the small worms, which, probably, constitute their food; for though nothing is found in their stomachs but liquid, and an earthy sediment, it must be that such soft bodies as worms, &c., dissolve there very quickly, and that the earth which enters along with them is the only substance unsusceptible of liquefaction. Autumn is the season for the arrival of the common snipe in most of the southern and western countries of Europe. It then extends through meadows, marshes, bogs, and along the banks of streams and rivers. When it walks, it carries the head erect, without either hopping or fluttering, and gives it a horizontal movement, while the tail moves up and down. When it takes flight, it rises so high as often to be heard after it is lost sight of. Its cry has been sometimes likened to that of the she-goat. The snipes for the most part, migrating northwards in the spring, nestle in Germany, Switzerland, Silesia, &c. Some, however, continue in their more southern stations, making their nest in the month of June, under the root of some alder or willow, in a sheltered place. This nest is composed of dry plants and feathers, and the female lays four or five oblong eggs, of a whitish tint, spotted with red. If the female be disturbed during incubation, she rises very high, and in a right line, then utters a particular cry, and re-descends with great rapidity. While the female is hatching, the male is frequently observed to hover around her, uttering a kind of hissing noise. The young quit the nest on issuing from the shell, and then appear very ugly and deformed. Until their bill grows firm, the mother continues her care of them, and does not leave them until they can do without her. The snipe usually grows very fat, both in Europe and North America; but much less so in warm climates. Its flesh, after the early frosts, acquires a fine and delicate flavour. It is cooked, as well as the woodcock, without being drawn, and is in universal estimation as an exquisite game. It is caught in various ways, and is well known to be a difficult shot, when turning and winding in the air; though by no means so when suffered to proceed in a right line, especially as the smallest grain of lead is sufficient to bring it down, and the slightest touch will make it fall.

The *Double snipe* was considered by Buffon as a mere variety of the common, as that naturalist probably took into consideration only its superior size, and the trifling difference of the plumage. It has, however, since his time, been ascertained to be a different species. It differs from the common snipe in its cry, in its flight, which is generally direct, and with few or no circlings, and in its habits, preferring to marshy and muddy grounds, those places where there is but little water, and where it is clear. There is little else worth remarking concerning it.

The *Little snipe* is not larger than a lark. It is less generally extended than the common species. In France, it remains in the marshes almost during the whole year, where it nestles and lays eggs, like those of the common snipe. Concealed in reeds and rushes, it remains there so pertinaciously that it is necessary almost to walk upon it to make it rise. Its flight is less rapid and more direct than that of the common snipe. Its fat is equally fine, and its flesh similarly well-flavoured. It is not very common in this country.

There are many other species of woodcock and snipe, but there is nothing in their habits to induce us to exceed the limits to which we are necessarily prescribed in this portion of our work.

The Godwits.—The woodcocks, properly so called, inhabit woods. The snipes live in fresh-water marshes; but the godwits prefer the sea-shore. The passage of the last into the temperate climates of Europe takes place in September, and, for their short stay, they frequent salt marshes, where, like the snipes, &c., they live on small worms, which they draw out of the mud. Those which are sometimes to be met with in inland places, have doubtless been driven there by the wind. Mauduyt, who observed some of them exposed for sale in the Parisian markets, in spring, concluded, and justly, that they make a second passage in spring, and not that they ever nestle on the French coasts. These timid birds, whose sight moreover is weak, remain in the shade during the day-time, and it is only by evening twilight, or early dawn, that they proceed in search of food, for the discrimination of which their bill is particularly fitted. Little stones are sometimes found in their gizzard, but we cannot conclude that these hard substances answer with them, as with the gallinæ, for the trituration of their food, which is too soft to require any thing of the kind, but rather that they have been taken in along with it. These birds are particularly wild, and fly precipitately from the slightest appearance of danger, uttering a cry which Belon compares to the smothered bleating of a she-goat. At the time of their arrival they are seen in flocks, and often heard, passing very high, in the evening or by moonlight. But the moment they alight, they are so much fatigued that they resume their flight with much difficulty; at such times, though they run with swiftness they can be easily turned, and sufficient numbers driven together to enable the fowler to kill several of them with a single shot. They remain but a short time at one place, and it is not uncommon to find them no longer in the morning, in those marshes, where, the preceding evening, they had been extremely numerous. Their flesh is excellent eating.

The Sanderlings.—The sanderlings are found in Europe, in Asia, in North America, and in New South Wales. They inhabit the sea-shores, and abound, in spring and autumn, both on the coasts of Holland and of this country. They are only seen accidentally in countries remote from the sea. There is but one species; but as these birds, which undergo two moultings, are most frequently seen in their summer plumage, in which red, or reddish, is the predominant colour, while in the winter it is gray, it is not wonderful that naturalists have made a dis-

inct species under the title of *Charadrius rubidus*. The sanderlings traverse in their periodical migrations a large portion of the globe. But they are only seen accidentally along rivers, which leads to the presumption that their aliment consists of small marine worms and insects. They breed in the North.

The Sandpipers.—The Sea-larks—a name exceedingly improper, as tending to the confusion of two genera widely remote—never quit the edge of waters, and especially prefer the sea-shore, although they occasionally remove to a considerable distance from it, since they are frequently seen around the lakes and along the rivers of the Vosges and the Pyrenees. They are birds of passage, at least in many countries of Europe. They proceed very far to the north; for they are found in Sweden, on the borders of the Caspian sea, and throughout the whole of Siberia. During winter they are very common both in France and England. The species is named by Latham, *Purpe Sandpiper*. Except during the nestling time, these birds unite in flocks, often so crowded, that a great number of them may be killed by a single shot. Nothing, says Belon, is more wonderful concerning this little bird, than to see five or six hundred dozens of them brought, on a single Saturday, in winter, to the Paris market. They constitute an excellent game, but must be eaten fresh; they are not, however, destitute of that oily taste, which appertains to almost all species of aquatic birds.

The Plovers.—The plovers habitually frequent the sea-coast, the mouths of rivers, and salt marshes. They feed upon crustacea, and small molluscous animals, which they catch in the sand along the line of waters, over which they are seen continually flying uttering a little cry. Many species live solitarily, or in couples; some others in small flocks. These birds are to be found in almost all the countries of the globe, from the equator to the coldest latitudes of the northern and southern hemispheres. They are all clad in sombre colours, the distribution of which is, however, not unpleasing. Most of them undergo a double moulting, and are vested in various liveries, according to age and sex. Some species have spines, which serve as defensive weapons, attached to their wings; some others have fleshy appendages at the base of the bill. The plovers emigrate every year, in flocks of greater or less numbers, and this principally takes place in autumn, during the rainy season, whence their French name (*pluviers*) is derived, and of which our word plover is an obvious corruption. At this time they are seen in the greatest abundance. They do not remain quiet when on the ground, but are seen in incessant motion. They fly in an extended file, or in transverse zones, very narrow and of a great length. Their flesh is delicate and much esteemed. They are frequently taken, in great quantities, in the countries where they are common, by means of nets variously fabricated.

Of these, the first and most common is the *Golden plover*. This bird frequents humid and marshy grounds. In winter it is very common on the coasts of France and Holland. It is found in England during the entire year; it is also very abundant in the Highlands of Scotland, in the Western Islands, and in the Isle of Man. It is again found in America, in Asia, and in the islands of the South Sea. Throughout the north of Europe it is common, and in all parts of Germany, Italy, and Spain. From the latter country we trace it into Barbary, and other parts of Africa; and it is to be found as far to the south-east of Asia, as India, China, and the Archipelago of the Eastern Ocean. These birds lay from three to five eggs, of rather an olive-green colour, with black spots. They live on worms, insects, and larvæ. There is very little difference in appearance between the male and female. These plovers strike the earth

with their feet to cause the worms, &c., to issue from their retreat. In the morning, like the lapwings and the snipes, they visit the water side to wash their bills and feet. They are rarely seen longer than twenty-four hours in the same place, which doubtless proceeds from their numbers, which cause a rapid exhaustion of their means of subsistence in any given spot. They migrate from the districts which they inhabit when the snow falls and the frost begins to be intense, as their resources of provision are then cut off, and they are deprived of the water, which their constitution renders indispensable to them. It is very rare to see a golden plover alone, and Belon tells us that the smallest flocks in which they fly amount at least to fifty each. When they are seeking their food, several of them act as sentinels, and on the appearance of any danger, set up a shrill cry, as a warning to the others, and a signal for flight. These flocks disperse in the evening, and each individual passes the night apart; but at the dawn of day, the first that awakes gives a cry of appeal to the rest, which immediately re-assemble on this call. This cry is imitated by the fowlers to draw these birds into their nets. The flesh of these plovers is in high estimation, in general, though the peculiarity of its flavour does not equally please every palate. It is best when the birds are rather fat than otherwise.

The Dotterel plover is about nine inches in length. Its bill is black; the cheeks and throat are white; the back and wings are of a light brown, inclining to olive; the breast is of a dull orange: the belly, thighs, and vent are of a reddish white; the tail is of an olive brown, and tipped with white; the legs are of a dark olive colour. The dotterel is common in various parts of Great Britain, though in some places it is scarce known. They are supposed to breed in the mountains of Cumberland and Westmoreland, where they are sometimes seen in the month of May, during the breeding season; they likewise breed on several of the Highland hills. They are very common in Cambridgeshire, Lincolnshire, and Derbyshire, appearing in small flocks on the heaths and moors of these counties during the months of May and June; and are then very fat, and much esteemed for the table. This bird is remarkable for its stupidity.

The Redshank.—This bird weighs about five ounces and a half; its length is twelve inches, and the breadth twenty-one. The bill, from the tip to the corners of the mouth, is more than an inch and three quarters long, black at the point, and red towards the base: the feathers on the crown of the head are dark brown, edged with pale rufous; a light or whitish line passes over, and encircles each eye, from the corners of which a dark brown spot is extended to the beak: irides hazel: the hinder part of the neck is obscurely spotted with dark brown, or a rusty ash-coloured ground; the throat and forepart are more distinctly marked in streaks of the same colour: on the breast and belly, which are white tinged with ash, the spots are thinly distributed, and are shaped something like the heads of arrows or darts.

The Spotted redshank.—The length of this bird, from the tip of the bill to the end of the tail, is twelve inches, and to the end of the toes fourteen inches and a half; its breadth twenty-one inches and a quarter; and its weight above five ounces avoirdupois. The bill is slender, measures two inches and a half from the corners of the mouth to the tip, and is, for half its length nearest the base, red; the other part black: irides hazel; the head, neck, breast, and belly, are spotted in streaks, mottled and barred with dingy ash brown and dull white, darker on the crown and hinder part of the neck; the throat is white; and lines of the same colour pass from the upper sides of the beak over

each eye, from the corners of which two brown ones are extended to the nostrils. The ground colour of the shoulders, scapulars, lesser coverts, and tail, is a glossy olive brown; the feathers on all these parts are indented on the edges, more or less, with triangular-shaped white spots. The back is white: the rump barred with wavy lines of ash-coloured brown, and dingy white: the vent feathers are marked nearly in the same manner, but with a greater portion of white: the tail and coverts are also barred with narrow wavy lines of a dull ash-colour, and, in some specimens, are nearly black and white. Five of the primary quills are dark brown, tinged with olive; the shaft of the first quill is white; the next six are, in the male, rather deeply tipped with white, and slightly spotted and barred with brown: the secondaries, as far as they are uncovered when the wings are extended, are of the same snowy whiteness as the back. The feathers which cover the upper part of the thighs, and those near them, are blushed with a reddish or vinous colour: the legs are of a deep orange red, and measure, from the end of the middle toe-nail to the upper bare part of the thigh, five inches and a half.

The *Green sandpiper*.—This bird measures about ten inches in length, to the end of the toes nearly twelve, and weighs about three ounces and a half. The bill is black, and an inch and a half long: a pale streak extends from it over each eye; between which, and the corners of the mouth, there is a dusky patch. The crown of the head, and the hinder part of the neck, are of a dingy, brownish-ash colour; in some specimens narrowly streaked with white. The throat is white; fore-part of the neck mottled or streaked with brown spots on a white or pale ash-coloured ground. The whole upper part of the plumage is of a glossy bronze, or olive brown, elegantly marked on the edge of each feather with small roundish white spots: the quills are without spots and are of a darker brown: the secondaries and tertials are very long: the insides of the wings are dusky, edged with white gray; and the inside coverts next the body are curiously barred, from the shaft of each feather to the edge, with narrow white lines, formed nearly of the shape of two sides of a triangle. The belly, vent, tail-coverts, and tail, are white; the last broadly barred with black, the middle feathers having four bars, and those next to them decreasing in the number of bars towards the outside feathers, which are quite plain: the legs are green.

The *Dunlin*.—This is the size of a jack-snipe. The upper parts of the plumage are ferruginous, marked with large spots of black and a little white; the lower parts are white, with dusky streaks. It is found in all the northern parts of Europe.

The *Lapwing* or *Peewit*.—This bird is about the size of a common pigeon, and is covered with very thick plumes, which are black at the roots, but of a different colour on the outward part. The feathers on the belly, thighs, and under the wings, are most of them white as snow; and the under part on the outside of the wings white, but black lower. It has a great liver, divided into two parts; and, as some authors affirm, no gall. Lapwings are found in most parts of Europe, as far northward as Iceland. In the winter they are met with in Persia and Egypt. Their chief food is worms; and sometimes they may be seen in flocks nearly covering the low marshy grounds in search of these, which they draw with great dexterity from their holes. When the bird meets with one of these little clusters of pellets, or rolls of earth that are thrown out by the worm's perforations, it first gently removes the mud from the mouth of the hole, then strikes the ground at the side with its foot, and steadily and attentively waits the issue; the reptile, alarmed by the shock, emerges from its retreat, and is instantly seized. These birds

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make a great noise with their wings when flying; and are called peewits, in Scotland and the north of England, from their particular cry. In other parts of the island they are called green plovers. They remain here the whole year. The female lays two eggs on the dry ground, near some marsh, upon a little bed which it prepares of dry grass: these are olive-coloured, and spotted with black. She sits about three weeks; and the young, who are covered with a thick down, are able to run two or three days after they are hatched.

The *Turnstone*.—This bird is about the size of a thrush; the bill is nearly an inch long, and turns a little upwards. The head, throat, and belly, are white; the breast black; and the neck encircled with a black colour. The upper parts of the plumage are of a pale reddish brown. These birds take their name from the method of finding their food, which is by turning up small stones with their bills to get the insects that lurk under them.

The *Whimbrel*.—The whimbrel is only about half the size of the curlew, which it very nearly resembles in shape, the colours of its plumage, and manner of its living. It is about seventeen inches in length, and twenty-nine in breadth; and weighs about fourteen ounces. The bill is about three inches long; the upper mandible black, the under one pale red. The upper part of the head is black, divided in the middle of the crown by a white line from the brow to the hinder part; between the bill and the eyes there is a darkish oblong spot; the sides of the head, the neck, and breast, are of a pale brown, marked with narrow dark streaks pointing downwards; the belly is of the same colour, but the dark streaks upon it are larger; about the vent it is quite white; the lower part of the back is also white. The rump and tail feathers are barred with black and white; the shafts of the quills are white, the outer webs totally black, but the inner ones marked with large white spots: the secondary quills are spotted in the same manner on both the outer and the inner webs. The legs and feet are of the same shape and colour as those of the curlew.

CHAP. XI.

OF THE WATER-HEN, AND THE COOT.

BEFORE we enter upon water-fowls, properly so called, two or three birds claim our attention, which seem to form the shade between the web-footed tribe and those of the crane kind. These partake rather of the form than the habits of the crane; and though furnished with long legs and necks, rather swim than wade. They cannot properly be called web-footed; nor yet are they entirely destitute of membranes, which fringe their toes on each side, and adapt them for swimming. The birds in question are, the Water-hen and the Bald-coot.

These birds have too near an affinity, not to be ranked in the same description. They are shaped entirely alike, their legs are long, and their thighs partly bare; their necks are proportionable, their wings short, their bill short and weak, their colour black, their foreheads bald and without feathers, and their habits entirely the same. These, however, naturalists have

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thought proper to range in different classes, from very slight distinctions in their figure. The water-hen weighs but fifteen ounces, the coot twenty-four. The bald part of the forehead in the coot is black; in the water-hen it is of a beautiful pink colour. The toes of the water-hen are edged with a straight membrane; those of the coot have it scolloped and broader.

The differences in the figure are but slight; and those in their manner of living still less. The history of the one will serve for both. As birds of the crane kind are furnished with long wings, and easily change place, the water-hen, whose wings are short, is obliged to reside entirely near those places where her food lies: she cannot take those long journeys that most of the crane kind are seen to perform; compelled by her natural imperfections, as well perhaps as by inclination, she never leaves the side of the pond or the river in which she seeks for provision. Where the stream is selvaged with sedges, or the pond edged with shrubby trees, the water-hen is generally a resident there; she seeks her food along the grassy banks, and often along the surface of the water. With Shakspeare's Edgar, she drinks the green mantle of the standing pool; or at least seems to prefer those places where it is seen. Whether she makes pond-weed her food, or hunts among it for water-insects, which are found there in great abundance, is not certain. I have seen them when pond-weed was taken out of their stomach. She builds her nest upon low trees and shrubs, of sticks and fibres, by the water-side. Her eggs are sharp at one end, white, with a tincture of green, spotted with red. She lays twice or thrice in a summer; her young ones swim the moment they leave the egg, pursue the parent, and imitate all her manners. She rears, in this manner, two or three broods in a season: and when the young are grown up, she drives them off to shift for themselves.¹

As the coot is a larger bird, it is always seen in larger streams, and more remote from mankind. The water-hen seems to prefer inhabited situations: she keeps near ponds, moats, and pools of water near gentlemen's houses; but the coot keeps in rivers, and among rushy margined lakes. It there makes a nest of such weeds as the stream supplies, and lays them among the reeds, floating on the surface, and rising and falling with the water. The reeds among which it is built keep it fast; so that it is seldom washed into the middle of the stream. But if this happens, which is sometimes the case, the bird sits in her nest, like a mariner in his boat, and steers with her legs her cargo into the nearest harbour: there, having attained her port, she continues to sit in great tranquillity, regardless of the impetuosity of the current; and though the water penetrates her nest, she hatches her eggs in that wet condition.

¹ See Supplementary Note A, p. 195.

The water-hen never wanders; but the coot sometimes swims down the current, till it even reaches the sea. In this voyage these birds encounter a thousand dangers: as they cannot fly far, they are hunted by dogs and men; as they never leave the stream, they are attacked and destroyed by otters; they are preyed upon by kites and falcons; and they are taken in still greater numbers in weirs made for catching fish; for these birds are led into the nets, while pursuing small fish and insects, which are their principal food. Thus animated nature affords a picture of universal invasion! Man destroys the otter,—the otter destroys the coot,—the coot feeds upon fish,—and fish are universally the tyrants of each other!

To these birds, with long legs and finny toes, I will add one species more,² with short legs and finny toes; I mean the Grebe. The entire resemblance of this bird's appetites and manners to those of the web-footed class, might justly induce me to rank it among them; but as it resembles those above-described, in the peculiar form of its toes, and bears some similitude in its manners also, I will for once sacrifice method to brevity. The grebe is much larger than either of the former, and its plumage white and black; it differs also entirely in the shortness of its legs, which are made for swimming, and not walking; in fact, they are from the knee upward hid in the belly of the bird, and have consequently very little motion. By this mark, and by the scolloped fringe of the toes, may this bird be easily distinguished from all others.

As they are thus, from the shortness of their wings, ill-formed for flying, and from the uncommon shortness of their legs utterly unfitted for walking, they seldom leave the water, and chiefly frequent those broad shallow pools where their faculty of swimming can be turned to the greatest advantage, in fishing and seeking their prey.

They are chiefly, in this country, seen to frequent the meres of Shropshire and Cheshire; where they breed among reeds and flags, in a floating nest, kept steady by the weeds of the margin. The female is said to be a careful nurse of her young, being observed to feed them most assiduously with small eels; and when the little brood is tired, the mother will carry them either on her back or under her wings. The bird preys upon fish, and is almost perpetually diving. It does not show much more than the head above water; and is very difficult to be shot, as it darts down on the appearance of the least danger. It is never seen on land; and, though disturbed ever so often, will not leave that lake, where alone, by diving and swimming, it can find food and security. It is chiefly sought for the skin of its breast, the plumage of which is of a most beautiful silvery white, and as glossy as satin. This part is made into tippets; but the skins are

² See Supplementary Note B, p. 196.

out of season about February, losing their bright colour; and in breeding-time their breasts are entirely bare.

NOTE A.—*The Water-hen.*

The Water-hen, or Green-footed gallinule, when seen running along the banks of a stream or pool, invariably calls to mind the idea of a young domestic fowl, its form and attitudes being extremely similar. The body, although much compressed, is rather full anteriorly; the neck of moderate length, the head oblong, compressed, and rather small. The bill, which does not exceed the head in length, is rather stout, tapering, and much compressed. The feet are large; the tibia muscular, its lower part bare, the tarsus of moderate length, large, compressed, anteriorly covered with broad, curved scutella; the toes very long, slender, compressed, the first, however, very small; the claws long, slender, slightly arched, compressed, acute. The plumage is blended, soft, glossy above; the wings short, concave, and rounded; the tail very short, arched, much rounded, of twelve weak, narrow, rounded feathers.

In the end of autumn, when the moult has been completed, the bill is greenish-yellow beyond the nostrils, the basal part, and frontal plate, crimson-red, the latter somewhat paler. The iris, which is very narrow, seems red at a little distance, but is composed of three rings, the outer hazel, the middle dusky, the inner bright red. The feet are dull green, with a ring of bright red above the tibio-tarsal joint; the claws dusky, the head, neck, and lower parts are of a dark grayish-blue, the abdomen tinged with pale gray, and the uppermost hypochondrial feathers, which are very long, have a longitudinal band of white on the outer web. The back and smaller wing-coverts are of a deep olive-brown. The quills, alula, and primary coverts, are dark brown, the secondary coverts the same, tinged with olive-brown, the first quill and first alular feather with the outer edge white, of which colour also is the edge of the wing. The tail is blackish-brown; the proximal under tail-coverts white, and a tuft of feathers under the middle of the latter deep black. The length is thirteen inches, and the extended wings measure twenty-two.

The water-hen is found in all parts of England and Scotland that are adapted to its nature. It frequents marshy places, pools, lakes, still streams, mill-dams, and even ditches, where it searches for food chiefly among the reeds and other aquatic plants along the shores. It swims with great ease and elegance, sitting lightly on the water, with its neck erect, and its tail obliquely raised. It dives with equal facility, and in travelling among the reeds, sedges, and other aquatic plants, makes its way with surprising ease, owing to the compression of its body, and its elongated toes. When surprised in a narrow stream or ditch, it usually dives, and conceals itself among the plants or beneath the banks, often remaining for a long time submersed, with nothing but the bill above the water. I have seen it thus betake itself to the margin, when on my going up to the spot, thinking the motion among the grass had been produced by a water-rat, it sprang up from under the water, and flew away. On other occasions, I have traced it under the overhanging earth, in a hole among the stones, and behind a waterfall. When disturbed in a large pool or lake, it either swims out to the open water, or betakes itself to the reeds or sedges, among which it remains concealed till the danger is over; and from its hiding-place it is not easily scared, for as its power of flight is not of a high order, it prefers the asylum of the water.

In swimming, it moves its neck backward and for-

ward, as a pigeon does when walking, a circumstance which becomes remarkable in this, as in some other birds, when compared with the swans, geese, and ducks, which keep the head steady while advancing on the water. In general, it is not so ready on being disturbed to betake itself to the open water as the coot, but prefers skulking along the shores. When a shot is fired at one, and has not hit, it often flies off, but often also keeps steadily swimming on. Being one evening with a friend at Seaton-marsh, on the Don, near Aberdeen, I started a water-hen, and let fly after it, on which it alighted at a very short distance, and concealed itself. My companion, however, having discovered it, took it up, but could perceive no injury that it had sustained. We carried it home, and having satisfied ourselves with observing its form and attitudes, took it back next day and let it loose, when it flew directly off to a great distance. It had evidently been paralyzed by terror. I have seen another when swimming right down the wind, after a shot had been fired at it, raise up the hind part of its body, and spread out its tail like a fan, which thus answered the purpose of a sail, and would have carried the bird on at a good rate, even if it had not made use of its oars.

It often perches on the stumps or trunks of willows growing in the water or hanging over it, or rests on a tuft or turf, where it may be seen standing on one foot, with its neck drawn in. Its ordinary position when reposing resembles that of the heron, the body being oblique, the legs straight, the head retracted; and in walking it raises its feet high, probably to prevent its long toes from being entangled. Early in the morning, often even at any time in the day, if it suspects no danger, it makes excursions into the fields or pastures adjoining its watery retreat, and walks along precisely with the air of a domestic fowl searching for food. It is extremely vigilant when on shore, and on the least alarm runs off with great speed, throwing its body forward, and stretching out its neck. Its flight is heavy, straight, performed by regular flappings, and very similar to that of the curlew. When flying over a short space, it allows its legs to dangle, and when alighting on the water, enters it at a very low angle, splashing it up with its wings, as is the manner of the coot and most species of the duck tribe. In rising, also, it moves a considerable way before fairly quitting the water, which it strikes with its wings, like the gannet, and most aquatic birds.

It is curious to observe with what facility the water-hen makes its escape, in circumstances in which one might at first suppose it impossible for it to get off in security. Thus, you may come upon one feeding in a narrow ditch filled with water. It instantly dives, or flies off a short way, and when you run up to the place where it has just alighted, and think you are sure of it, you find no traces of its existence. Watch as long as you please, no bird makes its appearance; it has sunk, and concealed itself somewhere along the margin, and there it will remain, with nothing but its bill above the surface, until you have departed, for it would require an eye sharper than that of a lynx to discover it. Although, when accustomed to the molestation of man, it is very vigilant, easily alarmed, and always prepared for flight, it is less wary in remote and unfrequented places. In some of the rushy lakes of the islands of Harris and North Uist, I have found it easier to get within shooting distance than in the mill-dams and streams of the lower districts of Scotland, where, should it observe you, even at a great distance, it is sure to be off instantly, and by the time you get to the place, it has concealed itself.

From the middle of April to the beginning of May, when vegetation has made some progress, but in the northern and more exposed parts of the country not

until the middle of that month, the water-hen commences the construction of its nest, which it places in the midst of a tuft of rushes or sedges, or fixes among reeds, or builds on a sedgy spot close to the water, or even sometimes on the trunk of a decayed tree or fallen willow. It is bulky, and composed of blades of reeds, grasses, fragments of decayed rushes or flags, and other aquatic plants. The eggs, which sometimes amount to eight or even ten, vary in form from regular ovate to nearly elliptical, and have a pale dull brownish-gray or grayish-yellow ground, with irregularly dispersed spots and dots of a deep brown colour, varying in size from the smallest perceptible by the naked eye to a diameter of nearly a quarter of an inch. Their average length is an inch and three-quarters, their breadth an inch and a quarter. The young, which are at first covered with long stiffish black down, leave the nest soon after they are hatched, and follow their mother. The sight of a flock is interesting, especially if you come suddenly upon it, for then the young scatter about in all directions, dive and conceal themselves, the old bird in the meanwhile lingering and displaying the greatest anxiety, until her brood is safe, when she too dives, and is no more to be seen.

The flesh of this bird is white, and in autumn and the beginning of winter, when there is a layer of fat under the skin, affords good eating, not much inferior to that of the partridge.—*W. Macgillivray.*

NOTE B.—*The Rails.*

As bearing some affinity to this genus of birds, we may here notice the *Rails*, so called from the rattling sound of their cry. These birds, which remain during the day concealed in the grass, seek their food morning and evening in the reeds and plants of marshes and meadows. They fly very far, and walk with great agility. They never join in families or flocks. They raise their neck like hens when they are disturbed, and the young quit the nest immediately after birth, and seize of their own accord the food which is indicated to them by the mother. To the land-rail, or corn-crake, these remarks are not perhaps applicable in all respects.

The *Water-rail* runs along stagnant waters as fast as the corn-crake does over the fields. Sometimes, instead of traversing the water by swimming, it sustains itself on the broad leaves of aquatic plants. Its food consists in insects, snails, and shrimps. It makes its nest in the midst of plants, by the side of ponds and streams, and the female lays from six to ten yellowish eggs, marked with spots of reddish-brown. The flesh of this bird has a marshy taste, but is, notwithstanding, in some estimation.

The *Corn-crake*, which, although it seldom comes under the observation of unprofessional admirers of Nature, is yet familiarly known by its cry, inasmuch, that to most people it is '*vox et præterea nihil*,' is a small bird intermediate in size between the quail and the partridge, having the body much compressed, the neck rather long and slender, the head small and oblong. The bill is somewhat shorter than the head, stout, tapering, and much compressed; the tongue rather short, fleshy, emarginate, and papillate at the base, flattened above, and pointed. The oesophagus is six inches long, of nearly uniform diameter and narrow, the stomach roundish compressed, large, with strong lateral muscles; the intestines twenty-five inches long, and of moderate width; the cæca three and a quarter, being large, and, like those of the gallinules, approaching in form to the cæca of the gallinaceous birds. The eyes are bare for nearly half an inch; the tarsus is of moderate length, compressed, but stout; the toes very long, slender, and compressed; the first very small; the claws of moderate length, slender, and

slightly arched. The plumage is blended; the wings short, concave, and rounded; the first quill much shorter than the second, which is slightly longer than the third; the tail extremely short, arched, much rounded, of twelve very weak feathers. The bill is light brown, the lower mandible whitish at the end; the iris light hazel, the feet bluish flesh-colour. The upper parts are light yellowish-brown, each feather marked with an oblong central spot of brownish-black, and laterally tinged with gray; the wing-coverts are light red, some of them imperfectly barred with white; a broad band of ash-gray passes over and behind the eye and ear, and the cheeks are tinged with the same; the face, fore-part and sides of the neck, are light yellowish-brown, tinged with gray; the sides and breast barred with light red and white; the lower wing-coverts and axillar feathers light red; the chin and abdomen brownish-white; the quills and primary coverts light brown, the outer webs tinged with light red; the edge of the wing, and outer web of the first alular feather and first quill, reddish-white; the inner secondaries, and the tail-feathers, like the back. The length is 10½ inches, the extended wings measure 18, the bill is eleven-twelfths, the tarsus 1½, the middle toe 1½, its claw three-twelfths.

"Were we," says Mr. Macgillivray, "to betake ourselves on some beautiful summer morning to one of the pastures that skirt the sandy shores of the remote Hebrides, anticipating the rising of the sun, and listening as we proceed in the gray twilight to the cries of the distant gulls, and the loud crash of the little wavelet, whose fall on the beach produces a louder noise than the rush of the mighty billow would do in a storm, we should not fail to see as well as to hear the corn-crake. Here let us crouch behind the turf wall, in view of that thicket of iris, and watch. There already, dimly seen, one is quietly walking along the grassy ridge, lifting high foot after foot, and sometimes stooping as if to peck up something. Now it stops, stands in a crouching posture, but on unbent legs, and commences its curious but monotonous song. Another is observed threading its way among the short grass of the adjoining piece of meadow land. The ruddy streaks in the east betoken the sun's approach to the horizon. There, along tide-mark, some dark-coloured bird approaches; it perceives us, wheels round, and comes up, announcing itself by its croak as the hooded crow. The crakes seem to understand the warning, and immediately betake themselves to the thicket, whence we can easily start them. Yet they sometimes allow you to come within a yard or two before they rise, and so closely do they sit, that I have once or twice seen a small pointer, which I had trained to bird-nesting, spring upon and seize one.

The corn-crake visits us early in May. It may seem strange that a bird apparently so ill adapted for continued flight, should yet be capable of performing the long journeys necessary for its annual visits. Its ordinary haunts are fields of corn and grass, and in the less cultivated parts of the country the large patches of flags and other tall herbaceous plants, which occur in moist places. It runs with great celerity, so much so, that I think a man could hardly overtake it, and it seems extremely averse from flying, for it seldom rises until one gets quite close to it. When it has started, it flies heavily, with considerable speed, allowing its legs to hang, and soon alights.

In an oat field in Harris, I once shot at a rail that suddenly rose among my feet, when, apparently not having been hit, it flew off in a direct course to the sea, about four hundred yards distant, where, to my surprise, it alighted and floated motionless, sitting lightly on the water, like a coot or gallinule. Soon after, a black-backed gull coming up, spied it

and, uttering a loud chuckle of delight, descended with rapidity, and carried it off in its bill. In this case, I think the bird was so frightened, although not hurt, that it entirely lost its presence of mind, as the water-hen sometimes does under similar circumstances.

At all times of the day, but more especially in the early morning, and towards twilight, it utters its singular and well-known cry, resembling the syllables *crek, crek*, repeated at short intervals, and often continuing for many minutes, probably a quarter of an hour or more, if the bird is not disturbed. It has the reputation of being an expert ventriloquist, and whether or not it deserves that title, it is certain that one is very apt to be mistaken as to the spot in which the bird is when he listens to its cry, which is at one time loud, at another low, now seems to indicate a close proximity, now a remote position, and even appears to come from various directions. I have heard the thrush and the robin so sing, close at hand, that I imagined them to be far away, and it is probable that other birds have the same faculty, which seems to depend upon the elongation or contraction of the trachea. When uttering its cry, the corn-crake usually remains still, standing with its neck considerably drawn in. I have watched it so employed through a hole in a wall. But I have also often seen it walk leisurely along at the time. As to its neck being "stretched, perpendicularly upwards," as alleged by Mr. Selby, it may perhaps sometimes be so, but not usually. At the period when the nights are shortest, I have heard it commence its cry so early as one in the morning.

Although not gaudily attired, the corn-crake is richly coloured, and when observed in its wild haunts, has an appearance of great elegance. It moves in a graceful manner, and when proceeding leisurely, walks with what might be called sedateness, lifting its feet rather high, jerking up its short tail, and bending its neck backwards and forwards at every step, like the water-hen. If alarmed, either while walking or while uttering its cry, it instantly ceases, stands still or crouches, and if it judges it expedient, starts off, throwing its neck out and its body forward. It is not gregarious at any period of its residence with us, although in favourable situations, such as extensive meadows, many individuals may sometimes be found not far from each other. Its food consists of worms, testaceous mollusca, and insects, especially

lepidoptera. Soon after its arrival, it begins to form its nest, which is composed of a few straws, laid in a slight hollow, among corn, or herbage of any kind. The eggs, which are of an elongated oval form, and of a light or cream-colour, pale grayish-yellow, patched, spotted and dotted with amber or brownish-red and light purplish blue or gray, are generally about ten, or from eight to twelve. In colour they bear a remarkable resemblance to those of the missel-thrush. Their average length is two inches and one-twelfth; their greatest breadth an inch and five-twelfths. The young are at first covered with long hair-like down of a blackish colour, and leave the nest immediately after they burst the shell, to follow their mother among the grass or corn. When only a few days old, they run with amazing celerity, and scatter about, so that when one falls in with a flock, it is very difficult to catch more than one or two of them. On such an occasion, I have seen the old bird come up and run about in great distress. Towards the middle of July, the crake ceases to utter its cry, and one might suppose that it then leaves the country: but the period of its departure is protracted to the beginning of September. I have seen young birds in the end of that month, and instances of their having been shot in winter have occurred in various parts of the country.

The flesh of this bird is white, and affords delicate eating; but this sort of game is not easily obtained in the more highly cultivated tracts. In the Hebrides and West Highlands, however, few birds are more common, inasmuch that there is hardly a patch of yellow iris or meadow-sweet, of the nettle, dock, or other tall weed, in which a crake or two may not be found. Its cry may be so successfully imitated by drawing an edged stick along the teeth of a comb, or a thin piece of bone along another which has been notched by a saw, that by this artifice the bird will sometimes be induced to come up. Pennant and Montagu state that on its first arrival it is very lean, but before its departure becomes excessively fat. I have never, however, seen any great difference in this respect, birds obtained early in the season being in as good condition as afterwards. The young, when fully fledged, differ from the old birds chiefly in wanting the bluish-gray markings on the head and neck. Individuals are often seen so late as the end of September, and a very few instances of their having been shot in winter have occurred."

BOOK VIII.

OF WATER-FOWL.

CHAP. I.

OF WATER-FOWL IN GENERAL.

IN settling the distinctions among the other classes of birds, there was some difficulty; one tribe encroached so nearly upon the nature and habitudes of another, that it was not easy to draw the line which kept them asunder: but in water-fowl, nature has marked them for us by a variety of indelible characters; so that it

would be almost as unlikely to mistake a land-fowl for one adapted for living and swimming among the waters, as a fish for a bird.

The first great distinction in this class appears in the toes, which are webbed together for swimming. Those who have remarked the feet or toes of a duck, will easily conceive how admirably they are formed for making way in the water. When men swim, they do not open the fingers, so as to let the fluid pass through them; but closing them together, present one broad

surface to beat back the water, and thus push their bodies along. What man performs by art, nature has supplied to water-fowl; and, by broad skins, has webbed their toes together, so that they expand two broad oars to the water; and thus, moving them alternately, with the greatest possible ease paddle along. We must observe also, that the toes are so contrived, that as they strike backward, their broadest hollow surface beats the water; but as they gather them in again, for a second blow, their front surface contracts, and does not impede the bird's progressive motion.

As their toes are webbed in the most convenient manner, so are their legs also made most fitly for swift progression in the water. The legs of all are short, except the three birds described in a former chapter; namely, the flamingo, the avosetta, and the corirra: all which, for that reason, I have thought proper to rank among the crane kind, as they make little use of their toes in swimming. Except these, all web-footed birds have very short legs; and these strike, while they swim, with great facility. Were the leg long, it would act like a lever whose prop is placed to a disadvantage; its motions would be slow, and the labour of moving it considerable. For this reason, the very few birds whose webbed feet are long, never make use of them in swimming: the web at the bottom seems only of service as a broad base, to prevent them from sinking while they walk in the mud; but it otherwise rather retards than advances their motion.

The shortness of their legs in the web-footed kinds, renders them as unfit for walking on land as it qualifies them for swimming in their natural element. Their stay, therefore, upon land, is but short and transitory; and they seldom venture to breed far from the sides of those waters where they usually remain. In their breeding seasons, their young are brought up by the water-side; and they are covered with a warm down, to fit them for the coldness of their situation. The old ones, also, have a closer, warmer plumage, than birds of any other class. It is of their feathers that our beds are composed; as they neither mat nor imbibe humidity, but are furnished with an animal-oil that glazes their surface, and keeps each other separate. In some, however, this animal-oil is in too great abundance, and is as offensive from its smell, as it is serviceable for the purposes of household economy. The feathers, therefore, of all the penguin kind are totally useless for domestic purposes; as neither boiling nor bleaching can divest them of their oily rancidity. Indeed, the rancidity of all new feathers, of whatever water-fowl they be, is so disgusting, that our upholsterers give near double the price for old feathers that they afford for new: to be free from smell, they must all be lain upon for some time; and their usual method is to mix the new and the old together.

This quantity of oil, with which most water-fowl are supplied, contributes also to their warmth in the moist element where they reside. their skin is generally lined with fat; so that, with the warmth of the feathers externally, and this natural lining more internally, they are better defended against the changes or the inclemencies of the weather, than any other class whatever.

As, among land-birds, there are some found fitted entirely for depredation, and others for a harmless method of subsisting upon vegetables, so also, among these birds, there are tribes of plunderers that prey, not only upon fish, but sometimes upon water-fowl themselves. There are likewise more inoffensive tribes, that live upon insects and vegetables only. Some water-fowls subsist by making sudden stoops from above, to seize whatever fish come near the surface; others again, not furnished with wings long enough to fit them for flight, take their prey by diving after it to the bottom.

From hence all water-fowl naturally fall into three distinctions. Those of the Gull kind, that, with long legs and round bills, fly along the surface to seize their prey: those of the Penguin kind, that, with round bills, legs hid in the abdomen, and short wings, dive after their prey: and, thirdly, those of the Goose kind, with flat broad bills, that lead harmless lives, and chiefly subsist upon insects and vegetables.

These are not speculative distinctions, made up for the arrangement of a system; but they are strongly and evidently marked by nature. The Gull kind are active and rapacious; constantly, except when they breed, keeping upon the wing; fitted for a life of rapine, with sharp straight bills for piercing, or hooked at the end for holding their fishy prey. In this class we may rank the albatross, the cormorant, the gannet or so-called-goose, the shag, the frigate-bird, the great brown gull, and all the lesser tribe of gulls and sea-swallows.

The Penguin kind, with appetites as voracious, bills as sharp, and equally eager for prey, are yet unqualified to obtain it by flight. Their wings are short, and their bodies large and heavy, so that they can neither run nor fly. But they are formed for diving in a very peculiar manner. Their feet are placed so far backward, and their legs so hid in the abdomen, that the slightest stroke sends them head foremost to the bottom of the water. To this class we may refer the penguin, the auk, the skout, the sea-turtle, the bottlenose, and the loon.

The Goose kind are easily distinguishable, by their flat broad bills covered with a skin, and their manner of feeding, which is mostly upon vegetables. In this class we may place the swan, the goose, the duck, the teal, the widgeon, and all their numerous varieties.

In describing the birds of these three classes, I will put the most remarkable of each class at

the beginning of their respective tribes, and give their separate history; then, after having described the chiefs of the tribe, the more ordinary sorts will naturally fall in a body, and come under a general description, behind their leaders. But before I offer to pursue this methodical arrangement, I must give the history of a bird that, from the singularity of its conformation, seems allied to no species; and should, therefore, be separately described—I mean the Pelican.

CHAP. II.

THE PELICAN.

THE Pelican of Africa is much larger in the body than a swan, and somewhat of the same shape and colour.¹ Its four toes are all webbed together; and its neck in some measure resembles that of a swan: but that singularity in which it differs from all other birds, is in the bill and the great pouch underneath, which are wonderful, and demand a distinct description. This enormous bill is fifteen inches from the point to the opening of the mouth, which is a good way back behind the eyes. At the base the bill is somewhat greenish, but varies towards the end, being of a reddish-blue. It is very thick in the beginning, but tapers off to the end, where it hooks downwards. The under chap is still more extraordinary; for to the lower edges of it hangs a

¹ The pelican affords an excellent illustration of the order of birds known as the Swimmers; the essential character of which consists in the membranous union of the toes, which renders them what is usually termed web-footed, and enables them to propel themselves upon the surface of the water with greater or less rapidity in proportion to the greater or less comparative extent of the membrane in which their toes are enveloped. They are all consequently inhabitants of marshy situations, of the banks of rivers and lakes, or of the sea-coast; and most of them seek their subsistence in their most congenial element, the water, notwithstanding that by far the greater number of them are also endowed with very considerable powers of flight.

Linnæus united under the common title of pelicans, the cormorants, the boobies, and several other birds, which differ from the typical species of the genus by many important characters, the chief point of agreement between them consisting in the form and extent of the membrane which unites the toes. The Linnæan group has subsequently been raised to the rank of a family, and its component parts form several distinct genera, that which comprehends the true pelicans, the genus *Onocrotalus* of Brisson, being characterized as follows. Their bill is of very great length, straight, broad, flattened above, and terminated by a slight hook; the lower mandible consists of two lateral branches, united at the point, and having interposed between them a membranous pouch capable of very great dilatation; their four toes are all enveloped to the very apex in the common membrane; their legs are short, strong, and maintain the body in a state of equilibrium, their lower part being entirely destitute of feathers.—ED.

bag, reaching the whole length of the bill to the neck, which is said to be capable of containing fifteen quarts of water. This bag the bird has a power of wrinkling up into the hollow of the under-chap: but by opening the bill, and putting one's hand down into the bag, it may be distended at pleasure. The skin of which it is formed will then be seen of a bluish ash-colour, with many fibres and veins running over its surface. It is not covered with feathers, but a short downy substance, as smooth and as soft as satin, and is attached all along the under edges of the chap, to be fixed backward to the neck of the bird by proper ligaments, and reaches near half way down. When this bag is empty it is not seen; but when the bird has fished with success, it is then incredible to what an extent it is often seen dilated. For the first thing the pelican does in fishing is to fill up the bag; and then it returns to digest its burden at leisure. When the bill is open to its widest extent, a person may run his head into the bird's mouth, and conceal it in this monstrous pouch, thus adapted for very singular purposes. Yet this is nothing to what Ruysch assures us, who avers, that a man has been seen to hide his whole leg, boot and all, in the monstrous jaws of one of these animals. At first appearance this would seem impossible, as the sides of the under chap, from which the bag depends, are not above an inch asunder when the bird's bill is first opened; but then they are capable of great separation; and it must necessarily be so, as the bird preys upon the largest fishes, and hides them by dozens in his pouch. Tertre affirms, that it will hide as many fish as will serve sixty hungry men for a meal.

Such is the formation of this extraordinary bird, which is a native of Africa and America. The pelican was once also known in Europe, particularly in Russia; but it seems to have deserted our coasts. This is the bird of which so many fabulous accounts have been propagated; such as its feeding its young with its own blood, and its carrying a provision of water for them in its great reservoir in the desert. But the absurdity of the first account answers itself; and as for the latter, the pelican uses its bag for very different purposes than that of filling it with water.

Its amazing pouch may be considered as analogous to the crop in other birds, with this difference, that as theirs lies at the bottom of the gullet, so this is placed at the top.—Thus, as pigeons and other birds macerate their food for their young in their crops, and then supply them, so the pelican supplies its young by a more ready contrivance, and macerates their food in its bill, or stores it for its own particular sustenance.

The ancients were particularly fond of giving this bird admirable qualities and parental affections; struck, perhaps, with its extraordinary figure, they were willing to supply it with as extraordinary appetites; and having found it with

a large reservoir, they were pleased with turning it to the most tender and parental uses.² But the truth is, the pelican is a very heavy, sluggish, voracious bird, and very ill fitted to take those flights, or to make those cautious provisions for a distant time, which we have been told they do. Father Labat, who seems to have studied their manners with great exactness, has given us a minute history of this bird, as found in America; and from him I will borrow mine.

The pelican, says Labat, has strong wings, furnished with thick plumage of an ash-colour, as are the rest of the feathers over the whole body. Its eyes are very small when compared to the size of its head; there is a sadness in its countenance, and its whole air is melancholy. It is as dull and reluctant in its motions as the flamingo is sprightly and active. It is slow of flight; and when it rises to fly, performs it with difficulty and labour. Nothing, as it would seem, but the spur of necessity could make these birds change their situation, or induce them to ascend into the air; but they must either starve or fly.

They are torpid and inactive to the last degree, so that nothing can exceed their indolence but their gluttony; it is only from the stimulations of hunger that they are excited to labour; for otherwise they would continue always in fixed repose. When they have raised themselves about thirty or forty feet above the surface of the sea, they turn their head with one eye downwards, and continue to fly in that posture. As soon as they perceive a fish sufficiently near the surface, they dart down upon it with the swiftness of an arrow, seize it with unerring certainty, and store it up in their pouch. They then rise again, though not without great labour, and continue hovering and fishing, with their head on one side as before.

This work they continue with great effort and

² In the account of the Tower Menagerie, published in 1829, we find the following statements respecting a pelican kept in the Tower of London. "The female is now sitting upon three eggs, and has built herself a very perfect nest for the purpose. Should these be brought to maturity, as there is every reason to expect, they will probably be the first that were ever hatched in England. She never quits her charge; but is fed by the male, who crams his pouch with double his usual allowance, and then proceeds to shovel her fair share into his partner's throat. It is in this manner also that the young are fed, the old bird pressing his full pouch against his chest, and contriving thus to disgorge a portion of its contents; an action which has no doubt given rise to the fabulous notion of the pelican's feeding its young with its own blood. In fact, the appearance of the bird when in this attitude, with the bloody spot on the end of its bill, closely pressed against the delicate plumage of its breast, may readily account for the prevalence of such an idea in the minds of superficial observers. The first traces of this fable are to be found in the writings of some of the early fathers of the church, and it was eagerly adopted by the heralds of later days, whose unbounded credulity was ever on the watch for the marvellous, in natural history more especially."—Ed.

industry till their bag is full, and then they fly to land to devour and digest at leisure the fruits of their industry.³ This, however, it would appear, they are not long in performing; for towards night they have another hungry call, and they again reluctantly go to labour. At night, when their fishing is over, and the toil of the day crowned with success, these lazy birds retire a little way from the shore; and, though with the webbed feet and clumsy figure of a goose, they will be contented to perch nowhere but upon trees, among the light and airy tenants of the forest. There they take their repose for the night; and often spend a great part of the day, except such times as they are fishing, sitting in dismal solemnity, and, as it would seem, half asleep. Their attitude is, with the head resting upon their great bag, and that resting upon their breast. There they remain without motion, or once changing their situation, till the calls of hunger break their repose, and till they find it indispensably necessary to fill their magazine for a fresh meal. Thus their life is spent between sleeping and eating; and our author adds, that they are as foul as they are voracious, as they are every moment voiding excrements in heaps as large as one's fist.

The same indolent habits seem to attend them even in preparing for incubation, and defending their young when excluded. The female makes no preparation for her nest, nor seems to choose any place in preference to lay in; but drops her eggs on the bare ground to the number of five or six, and there continues to hatch them. Attached to the place, without any desire of defending her eggs or her young, she tamely sits, and suffers them to be taken from under her. Now

³ The pelican is one of the largest water-birds, considerably exceeding the size of the swan, and frequently measuring from five to six feet between the extremity of the bill and that of the tail, and from ten to twelve between the tips of the expanded wings. Its bill is nearly a foot and a half in length, and from an inch and a half to two inches broad; and its pouch is capable of containing, when stretched to its utmost extent, two or three gallons of water. The quantity of fish which it sometimes accumulates in the same serviceable repository is spoken of as enormous. Notwithstanding their great bulk and apparent clumsiness, the large extent of their wings, and the extreme lightness of their bones, which are so thin as to be almost transparent, enable these birds to rise to a lofty pitch in the air, to hover at a moderate elevation, or to skim rapidly along the surface of the water with as much facility as they dive into its depths in pursuit of their prey. They sometimes assemble in large numbers, and in this case are said by Buffon to act in concert, and to show no little skill in manœuvring with the view of securing a plentiful quarry, forming themselves into a circular line, and gradually narrowing the extent of the space enclosed, until they have driven the fishes into so small a compass as to render them a certain prey; when at a given signal they all at once plunge into the water and seize upon their terrified victims, filling their pouches with the spoil, and flying to the land, there to devour it at their leisure. This fishery is carried on both at sea and in fresh-water.—Ed.

and then she just ventures to peck, or to cry out when a person offers to beat her off.

She feeds her young with fish macerated for some time in her bag; and when they cry, flies off for a new supply. Labat tells us, that he took two of these when very young, and tied them by the leg to a post stuck into the ground, where he had the pleasure of seeing the old one for several days come to feed them, remaining with them the greatest part of the day, and spending the night on a branch of a tree that hung over them. By these means they were all three become so familiar, that they suffered themselves to be handled; and the young ones very kindly accepted whatever fish he offered them. These they always put first into their bag, and then swallowed at their leisure.

It seems, however, that they are but disagreeable and useless domestics; their gluttony can scarcely be satisfied; their flesh smells very rancid; and tastes a thousand times worse than it smells. The native Americans kill vast numbers; not to eat, for they are not fit even for the banquet of a savage; but to convert their large bags into purses and tobacco pouches. They bestow no small pains in dressing the skin with salt and ashes, rubbing it well with oil, and then forming it to their purpose. It thus becomes so soft and pliant, that the Spanish women sometimes adorn it with gold and embroidery to make work-bags of.

Yet with all the seeming habitudes of this bird, it is not entirely incapable of instruction in a domestic state. Father Raymond assures us, that he has seen one so tame and well educated among the native Americans, that it would go off in the morning at the word of command, and return before night to its master, with its great pouch distended with plunder; a part of which the savages would make it disgorge, and a part they would permit it to reserve for itself.

"The Pelican," as Faber relates, "is not destitute of other qualifications. One of those which was brought alive to the duke of Bavaria's court, where it lived forty years, seemed to be possessed of very uncommon sensations. It was much delighted in the company and conversation of men, and in music both vocal and instrumental: for it would willingly stand," says he, "by those that sung, or sounded the trumpet; and stretching out its head, and turning its ear to the music, listened very attentively to its harmony; though its own voice was little pleasanter than the braying of an ass." Gesner tells us that the emperor Maximilian had a tame pelican, which lived for above eighty years, and that always attended his army on their march. It was one of the largest of the kind, and had a daily allowance by the emperor's orders. As another proof of the great age to which the pelican lives, Aldrovandus makes mention of one of these birds that was kept several years at Mechlin, and was verily believed to be fifty

years old.—We often see these birds at our shows about town.

CHAP. III.

OF THE ALBATROSS, THE FIRST OF THE GULL KIND.

THOUGH this is one of the largest and most formidable birds of Africa and America, yet we have but few accounts to enlighten us in its history. The figure of the bird is thus described by Edwards: "The body is rather larger than that of a pelican; and its wings, when extended, ten feet from tip to tip. The bill, which is six inches long, is yellowish, and terminates in a crooked point. The top of the head is of a bright brown; the back is of a dirty deep spotted brown; and the belly and under the wings is white; the toes, which are webbed, are of a flesh colour."

Such are the principal traits in this bird's figure: but these lead us a very short way in its history; and our naturalists have thought fit to say nothing more. However, I am apt to believe this bird to be the same with that described by Wicquefort, under the title of the Alcatraz; its size, its colours, and its prey, incline me to think so. He describes it as a kind of great gull, as large in the body as a goose, of a brown colour, with a long bill, and living upon fish, of which they kill great numbers.

This bird is an inhabitant of the tropical climates, and also beyond them as far as the Straits of Magellan in the South Seas. It is one of the most fierce and formidable of the aquatic tribe, not only living upon fish, but also such small water-fowl as it can take by surprise. It preys, as all the gull kind do, upon the wing; and chiefly pursues the flying-fish, that are forced from the sea by the dolphins. The ocean in that part of the world presents a very different appearance from the seas with which we are surrounded. In our seas we see nothing but a dreary expanse, ruffled by winds, and seemingly forsaken by every class of animated nature. But the tropical seas, and the distant southern latitudes beyond them, are all alive with birds and fishes, pursuing and pursued. Every various species of the gull-kind are there seen hovering on the wing, at a thousand miles' distance from the shore. The flying-fish are every moment rising to escape from their pursuers of the deep, only to encounter equal dangers in the air. Just as they rise the dolphin is seen to dart after them, but generally in vain; the gull has more frequent success, and often takes them at their rise; while the albatross pursues the gull, and obliges it to relinquish its prey; so that the whole horizon presents but one living picture of rapacity and evasion.

So much is certain; but how far we are to credit Wicquefort, in what he adds concerning

this bird, the reader is left to determine. "As these birds, except when they breed, live entirely remote from land, so they are often seen, as it should seem, sleeping in the air. At night, when they are pressed by slumber, they rise into the clouds as high as they can; there, putting their head under one wing, they beat the air with the other, and seem to take their ease. After a time, however, the weight of their bodies, only thus half supported, brings them down; and they are seen descending, with a pretty rapid motion, to the surface of the sea. Upon this they again put forth their efforts to rise; and thus alternately ascend and descend at their ease. But it sometimes happens," says my author, "that in these slumbering flights, they are off their guard, and fall upon deck, where they are taken."

What truth there may be in this account I will not take upon me to determine: but certain it is, that few birds float upon the air with more ease than the albatross, or support themselves a longer time in that element. They seem never to feel the accesses of fatigue; but night and day upon the wing, are always prowling, yet always emaciated and hungry.

But though this bird be one of the most formidable tyrants of the deep, there are some associations which even tyrants themselves form, to which they are induced either by caprice or necessity. The albatross seems to have a peculiar affection for the penguin, and a pleasure in its society. They are always seen to choose the same places for breeding; some distant uninhabited island, where the ground slants to the sea, as the penguin is not formed either for flying or climbing. In such places their nests are seen together, as if they stood in need of mutual assistance and protection. Captain Hunt, who for some time commanded at our settlement upon Falkland Islands, assures me, that he was often amazed at the union preserved between these birds, and the regularity with which they built together. In that bleak and desolate spot, where the birds had long continued undisturbed possessors, and no way dreaded the encroachments of men, they seemed to make their abode as comfortable as they expected it to be lasting. They were seen to build with an amazing degree of uniformity; their nests covering fields by thousands, and resembling a regular plantation. In the middle, on high, the albatross raised its nest, on heath, sticks, and long grass, about two feet above the surface: round this the penguins made their lower settlements, rather in holes in the ground, and most usually eight penguins to one albatross. Nothing is a stronger proof of Mr. Buffon's fine observation, that the presence of man not only destroys the society of meaner animals, but their instincts also. These nests are now, I am told, totally destroyed; the society is broke up; and the albatross and penguin have gone to breed upon more desert shores, in greater security.

SUPPLEMENTARY NOTE.

The Albatross is also called 'the man-of-war bird.' In the West Indies these birds are said to foretell the arrival of ships; which is frequently true, and may arise from a very natural cause. They always fish in fine weather; so that, when the wind is rough at sea, they retire into the harbours, where they are protected by the land; and the same wind that blows them in, brings likewise whatever vessels may be exposed to its fury, to seek a retreat from it. They devour fish with great gluttony, and are often so gorged as to be unable to fly. Their cry resembles the braying of an ass.

The *Chocolate albatross* inhabits the Pacific ocean. It is three feet long. The bill is whitish; the body of a deep chestnut brown colour: belly pale; face and wings beneath whitish. The irides are brown; the legs bluish white, with white claws.

The *Yellow-nosed albatross* is white in general colour; the bill black; keel of the upper mandible, and base of the lower one, yellow; the body above is of a black-blue colour; beneath it is white. It inhabits the Pacific ocean, and is about three feet long. The irides are brown; the nape of the neck and rump, white; the legs are pale yellow; the fore-part and connecting membrane, dusky.

"Dr. Arnott, as quoted by Mr. Rennie, remarks, 'How powerful must be the wing muscles of birds which sustain themselves in the sky for many hours! The great albatross, with wings extended 14 ft. or more, is seen, in the stormy solitudes of the Southern Ocean, accompanying ships for whole days, without ever resting on the waves.' Mr. Main, whom apprehension of exceeding the truth always leads to speak within bounds, gives the spread of the wings at 9 or 10 ft.; Dr. Arnott, as appears by Mr. Rennie's quotation, at '14 ft. or more;' while the specimen in the Zoological Society's museum, in Bruton Street, and we have seen this specimen, is set down in the Society's Catalogue, where a picture of it is given, at the following dimensions:—'Length from tip of bill to extremity of tail, 3 ft. 4 in.; expansion of wings, 9 ft.' The mean of these three statements of the spread of the wings of the albatross, is 10 ft. 10 in.; and although true, without doubt, is the proverb *Medio tutissimus ibis* (the middle course is the safest), we care less about the precise dimensions than to show that the expansion is on all hands admitted to be great. This great expansion of wings, and that wonderful provision in the physiology of birds, by which they are enabled to charge and fill every bone in their body with rarefied air, to promote and secure, as by a series of balloons, their buoyancy; and, together with the comparative smallness, and therefore lightness, of the body of the albatross, in part prepare us to give credence to a supposition entertained by some, that this bird sleeps while on the wing, and the great distance from any land at which it is frequently seen towards the close of day farther favours the supposition. This power of sleeping in the air has been alluded to by Thomas Moore, in his beautiful Eastern poem of 'Lalla Rookh,' where, describing a rocky mountain beetling awfully o'er the Sea of Oman, he says,

'While on its peak, that braved the sky,
A ruin'd temple tower'd, so high
That oft the sleeping albatross
Struck the wild ruins with her wing,
And from her cloud-rock'd slumbering
Started, to find man's dwelling there
In her own silent fields of air.'

This elegant quotation was kindly pointed out to us by S. T. P., whose lucid remarks have so often enriched our pages. The albatross is doubtless spoken of in the following facts told us by a sailor-friend, now dead and gone:—'A very large bird sometimes

alights upon the yards of vessels passing the coast of the Cape of Good Hope; and no sooner is it upon the yards than it is asleep, and, while sleeping, is very easily captured. When upon the deck, it cannot soar into the air, on account of the length of its wings. It makes a loud and disagreeable noise when molested. It is called the booby by the crew. The term 'booby' is, we have since been told, commonly applied by sailors to any long-winged bird of a whitish colour; although, in the above case of the albatross, the term would seem to express its incautious or booby-like habit of going to sleep within reach of molestation; a habit which those who scout the idea of the bird's sleeping in the air will impute to the desperateness of its necessity."—*London's Magazine of Natural History*, vol. vi. pp. 372—374.

CHAP. IV.

THE CORMORANT.

The Cormorant is about the size of a large Muscovy duck, and may be distinguished from all other birds of this kind, by its four toes being united by membranes together; and by the middle toe being toothed or notched like a saw, to assist it in holding its fishy prey. The head and neck of this bird are of a sooty blackness; and the body thick and heavy, more inclined in figure to that of the goose than the gull. The bill is straight, till near the end, where the upper chap bends into a hook.

But notwithstanding the seeming heaviness of its make, there are few birds more powerfully predaceous. As soon as the winter approaches, they are seen dispersed along the sea-shore, and ascending up the mouths of fresh-water rivers, carrying destruction to all the finny tribe. They are most remarkably voracious, and have a most sudden digestion. Their appetite is for ever craving, and never satisfied. This gnawing sensation may probably be increased by the great quantity of small worms that fill their intestines, and which their unceasing gluttony contributes to engender.

Thus formed with the grossest appetites, this unclean bird has the most rank and disagreeable smell, and is more fetid than even carrion, when in its most healthful state. Its form, says an ingenious modern, is disagreeable; its voice is hoarse and croaking; and all its qualities obscene. No wonder then that Milton should make Satan personate this bird, when he sent him upon the basest purposes, to survey with pain the beauties of Paradise, and to sit devising death on the tree of life.¹ It has been remarked, however, of our poet, that the making a water-fowl perch upon a tree, implied no great acquaintance with the history of nature. In vindication of Milton, Aristotle expressly says, that the cormorant is the only water-fowl that sits

on trees. We have already seen the pelican of this number; and the cormorant's toes seem as fit for perching upon trees as for swimming; so that our epic bard seems to have been as deeply versed in natural history as in criticism.

Indeed this bird seems to be of a multiform nature; and wherever fish are to be found, watches their migrations. It is seen as well by land as sea; it fishes in fresh-water lakes, as well as in the depths of the ocean; it builds in the cliffs of rocks as well as on trees, and preys not only in the day-time, but by night.

Its indefatigable nature, and its great power in catching fish, were probably the motives that induced some nations to breed this bird up tame, for the purpose of fishing; and Willoughby assures us, it was once used in England for that purpose. The description of their manner of fishing is thus delivered by Faber. "When they carry them out of the rooms where they are kept, to the fish-pools, they hoodwink them, that they may not be frightened by the way. When they are come to the rivers, they take off their hood; and having tied a leather thong round the lower part of their necks, that they may not swallow down the fish they catch, they throw them into the river. They presently dive under water, and there for a long time, with wonderful swiftness, pursue the fish; and when they have caught them, rise to the top of the water, and pressing the fish lightly with their bills, swallow them; till each bird hath, after this manner, devoured five or six fishes. Then their keepers call them to the fist, to which they readily fly; and, one after another, vomit up all their fish, a little bruised with the first nip, given in catching them. When they have done fishing, setting their birds on some high place, they loose the string from their necks, leaving the passage to the stomach free and open; and, for their reward, they throw them part of their prey; to each one or two fishes, which they will catch most dexterously, as they are falling in the air.

At present the cormorant is trained in every part of China for the same purpose, where there are many lakes and canals. "To this end," says Le Compte, "they are educated as men rear up spaniels or hawks, and one man can easily manage a hundred. The fisher carries them into the lake, perched on the gunnel of his boat, where they continue tranquil, and expecting his orders with patience. When arrived at the proper place, at the first signal given each flies a different way to fulfil the task assigned it. It is very pleasant, on this occasion, to behold with what sagacity they portion out the lake or the canal where they are upon duty. They hunt about, they plunge, they rise a hundred times to the surface, until they have at last found their prey. They then seize it with their beak by the middle, and carry it without fail to their master. When the fish is too large, they then give each other mutual assistance: one seizes it by the head, the other

¹ Vide Pennant's *Zoology*, p. 477.

by the tail, and in this manner carry it to the boat together. There the boatman stretches out one of his long oars, on which they perch, and being delivered of their burden, they fly off to pursue their sport. When they are wearied, he lets them rest for a while; but they are never fed till their work is over. In this manner they supply a very plentiful table; but still their natural gluttony cannot be reclaimed even by education. They have always while they fish the same string fastened to their throats, to prevent them from devouring their prey, as otherwise they would at once satiate themselves, and discontinue their pursuit the moment they had filled their bellies."

As for the rest, the cormorant is the best fisher of all birds; and though fat and heavy with the quantity it devours, is nevertheless generally upon the wing. The great activity with which it pursues, and from a vast height drops down to dive after its prey, offers one of the most amusing spectacles to those who stand upon a cliff on the shore. This large bird is seldom seen in the air, but where there are fish below; but then they must be near the surface before it will venture to souse upon them. If they are at a depth beyond what the impetus of its flight makes the cormorant capable of diving to, they certainly escape him; for this bird cannot move so fast under water as the fish can swim. It seldom, however, makes an unsuccessful dip; and is often seen rising heavily, with a fish larger than it can readily devour. It sometimes also happens, that the cormorant has caught the fish by the tail; and consequently the fins prevent its being easily swallowed in that position. In this case, the bird is seen to toss its prey above its head, and very dexterously to catch it, when descending, by the proper end, and so swallow it with ease.

SUPPLEMENTARY NOTE.

The Cormorants are found in all parts of the globe, and are equally good divers and swimmers. When they swim, they frequently have the head alone out of the water; and in diving, they pursue with the most astonishing swiftness the prey which they have perceived, and which seldom succeeds in escaping them. When they have taken it they return to the surface, and to swallow it the more easily, they throw it into the air, and receive the head, so that the fins may incline in the passage of the gullet, while the membranous skin inclines so as to let pass the entire body of the fish, which is often very large, in proportion to the neck of the bird. In many places, but more especially in China, cormorants have been employed in fishing, a ring being put on the lower part of the neck to prevent them from swallowing the fish, which they are taught to bring back to their master. They usually inhabit the borders of the sea and the mouths of rivers, and feed on various kinds of fish. When their appetite is sated, they perch on trees like other birds of similar palmation. They have a double moulting.

The following account of the Chinese cormorant by Sir George Staunton, is the most authentic of any that has yet been given to us. "The Embassy," he says, "had not proceeded far on the southern

branch of the Imperial canal, when they arrived in the vicinity of a place where the Leu-tze, or famed fishing-bird of China, is bred, and instructed in the art of supplying his owner with fish in great abundance. It is a species of the pelican, resembling the common cormorant; but on a specimen being submitted to Dr. Shaw, he has distinguished it in the following terms. Brown pelican, or cormorant, with white throat; the body whitish beneath; the tail rounded, the irides blue; the bill yellow. On a large lake close to this part of the canal, and to the eastward of it, are thousands of small boats and rafts built entirely for this species of fishing. On each boat or raft are ten or a dozen birds, which at a signal from the owner plunge into the water; and it is astonishing to see the enormous size of the fish with which they return grasped within their bills. They appear to be so well trained, that it did not require either ring or cord about their throats to prevent them from swallowing any portion of their prey, except what their master was pleased to return to them for encouragement and food. The boat used by these fishermen is of a remarkably light make, and is often carried to the lake, together with the fishing-birds, by the men who are there to be supported by it."

"If by accident a large fish sticks in its gullet," says Professor Rennie, "it has the power of inflating that part to the utmost, and while in that state, the head and neck are shaken violently, in order to promote its passage. This is a property we never observed in any other bird, but it is probably common to the rest of the tribe, or such as are destitute of nasal apertures. That all birds have a communication between their lungs and the cavity of their body surrounding the viscera, more or less, is well known; but as there is no passage into the œsophagus but by the mouth, to effect this inflation, a violent compression of the body becomes necessary at the same time the bill is closed, and the air is forced back into the mouth and pressed into the gullet. It is observable, that, in the act of fishing, this bird always carries it head under water, in order that it may discover its prey at a greater distance, and with more certainty than could be effected by keeping its eyes above the surface, which is agitated by the air, and rendered unfit for visual purposes. If the fish is of the flat kind, it will turn it in the bill, so as to reverse its position, and by this means such could only be got within the bill: if it succeeds in capturing an eel, which is its favourite food, in an unfavourable position for gorging, it will throw up the fish to a distance, dexterously catching it in a more favourable one as it descends. In thus turning the fish, the dilatable skin under the bill is of great use, but is by no means deserving the name of a pouch, not being capable of more distension than any other part of the œsophagus, nor can it be used as a reservoir for provision, either for its own use, or for the use of its young, as asserted by some authors. Another action which seems peculiar to this bird and its congeners, is violently beating the water with its wings, without moving from the spot, followed by a shake of the whole body, ruffling all its feathers, at the same time covering itself with water. This singular action it will repeat twenty times, with small intervals of rest, when it will retire to an elevated place on shore, and spread and flap its wings till they are dry."

It is no uncommon thing to see twenty of these birds together on the rocks of the sea-coast, with extended wings, drying themselves in the wind. In this position they remain sometimes nearly an hour, without closing the wings; and as soon as these are sufficiently dry to enable the feathers to imbibe the oil, they press this substance from the receptacle on their rumps, and dress the feathers with it. It is

only in one particular state that the oily matter can be spread on them,—when they are somewhat damp; and the instinct of the birds teaches them the proper moment. The skins of the cormorants are very tough; and are used by the Greenlanders, when sewed together and put into proper form, for garments. And the skin of the jaws, like that of others of this tribe, serves these people for bladders to buoy up their smaller kinds of fishing darts.

The *Shag*, or *Lesser cormorant*, is in length two feet six inches; and the extent of its wings eight feet. The general colour of its plumage is black; the belly is dusky; and the head and neck glossed with green.

The *Crested shag* is somewhat less than the preceding, and is less common. There are two kinds which are natives of Kamtschatka; these are distinguished as the violet and the red-faced shags, being so ornamented with those colours. Besides there are several others found in New Zealand, and also in Africa; in the latter of which there are two species not larger than a teal. The whole of these, like the cormorants, build in trees.

The *Frigates* are birds of the cormorant genus, which inhabit the intertropical seas of both worlds. They chiefly pursue the flying fish, darting upon them with amazing rapidity. They also attack the booby bird, which they force to disgorge or drop its booty.

The *Red-backed pelican* is reddish in general colour; the head, crested; the neck, reddish white; the tail, of a dusky ash-colour; the gullet, pouched. It is an inhabitant of Africa, and is five feet long. The bill, and naked area of the eyes, and pouch, are dirty yellow; the crest is four inches long; the body beneath is pale; the quill-feathers are black; and the scapulars of a gray lead colour; the feathers of the breast are long and narrow; the legs are yellow. This bird, like others of its race, is very voracious.

The *Anhingas*, *plotus*, or *Darter* of Latham, are birds which inhabit the most southern and the warmest regions of both continents, where they frequent fresh waters, and inundated savannahs. They perch on trees which border the shore, pass the night there, and construct their nest on the most elevated branches. They swim and dive after fish. If the fish which they catch is small, they swallow it entire, without leaving the water. If too large, they carry it on a rock, or the trunk of a tree, and divide it with the bill and feet. When the anhingas fly, the neck, stretched out, forms a horizontal line with the tail; but when they are at rest, its perpetual oscillation considerably augments its resemblance to a snake. Being extremely wild, these birds are but seldom seen on land; and when they swim, their head is almost the only part which is out of the water, into which they plunge altogether on the slightest appearance of danger, and do not reappear but at considerable distances. Even then, they only show themselves for the time which is necessary for respiration. Such is their cunning, that they having dived at the distance of a hundred paces beyond the pursuer, they emerge to respire the air at more than a thousand paces behind him, until finding some reeds, they conceal themselves there, and appear no more. Their skin is very thick, and the flesh oily and ill-flavoured.

The *Plotus Anhinga*, according to Bartram, live in small societies, and assemble on the dry branches which hang over rivers. When surprised, they drop into the water, as if dead, and after one or two minutes they reappear, at a great distance, showing nothing but the neck, and sometimes the end of the tail. During the heat of the day, they fly in great numbers, to a considerable elevation in the air, over lakes and rivers.

The *Phaeton*, or *Tropic birds*, received from Lin-

næus the former appellation, because, from their habitual residence under the burning zone, bounded by the tropics, they seem attached to the chariot of the sun. From this climate they remove but little, and are rarely seen beyond the 21st parallel of south latitude. Their appearance, accordingly, indicates to mariners their approaching passage under this zone, from whatever side they may arrive. Still they advance sea-ward, many hundreds of leagues. These birds have a mode of flying peculiar to themselves. They appear, from a sort of trembling, to be extenuated with fatigue, and on the point of falling. They drop down from a considerable height, abandoning themselves to their weight, and seize the fish without diving. But when they pursue the flying-fish, which constitute their principal aliment, they shave the surface of the water. When they perceive a vessel, they come to reconnoitre it, hovering above its head. They are particularly attracted by any thing red.

The tropic-birds, like the cormorants, perch on the highest trees; and it is supposed that when they are at a very considerable distance from all land, they are enabled, by means of their completely palmated feet, to repose upon the sea. They make their nests in the holes of precipitous rocks, or in the hollows of trees. The young, yet in the nest, gathered up in a ball, and covered with a down of the most brilliant white, have a resemblance to powder puffs. Of the long tail feathers, (sometimes twenty-four inches,) the Otaheitans make plumes for their warriors; and the Caribs used to pass them through the cartilage of the nose, to render themselves more handsome, or more terrible.

CHAP. V.

OF THE GANNET, OR SOLAND GOOSE.

THE Gannet is of the size of a tame goose, but its wings much longer, being six feet over. The bill is six inches long, straight almost to the point, where it inclines down, and the sides are irregularly jagged, that it may hold its prey with greater security. It differs from the cormorant in size, being larger; and its colour, which is chiefly white; and by its having no nostrils, but in their place a long furrow that reaches almost to the end of the bill. From the corner of the mouth is a narrow slip of black bare skin, that extends to the hind part of the head; beneath the skin is another that, like the pouch of the pelican, is dilatable, and of size sufficient to contain five or six entire herrings, which in the breeding season it carries at once to its mate or its young.

These birds, which subsist entirely upon fish, chiefly resort to those uninhabited islands where their food is found in plenty, and men seldom come to disturb them. The islands to the north of Scotland, the Skelig islands off the coast of Kerry in Ireland, and those that lie in the north sea off Norway, abound with them. But it is on the Bass island, in the Firth of Edinburgh, where they are seen in the greatest abundance. "There is a small island," says the celebrated Harvey, "called the Bass, not more than a mile

in circumference. The surface is almost wholly covered during the months of May and June with their nests, their eggs, and young. It is scarcely possible to walk without treading on them: the flocks of birds upon the wing are so numerous as to darken the air like a cloud; and their noise is such, that one cannot without difficulty be heard by the person next to him. When one looks down upon the sea from the precipice, its whole surface seems covered with infinite numbers of birds of different kinds, swimming and pursuing their prey. If, in sailing round the island, one surveys its hanging cliffs, in every crag, or fissure of the broken rocks, may be seen innumerable birds, of various sorts and sizes, more than the stars of heaven, when viewed in a serene night. If they are viewed at a distance, either receding, or in their approach to the island, they seem like one vast swarm of bees."

They are not less frequent on the rocks of St. Kilda. Martin assures us, that the inhabitants of that small island consume annually near twenty-three thousand young birds of this species, besides an amazing quantity of their eggs. On these they principally subsist throughout the year; and from the number of these visitants, make an estimate of their plenty for the season. They preserve both the eggs and fowls in small pyramidal stone buildings, covering them with turf ashes, to prevent the evaporation of their moisture.

The gannet is a bird of passage. In winter it seeks the more southern coasts of Cornwall, hovering over the shoals of herrings and pilchards that then come down from the northern seas; its first appearance in the northern islands is in the beginning of spring; and it continues to breed till the end of summer. But, in general, its motions are determined by the migrations of the immense shoals of herrings that come pouring down at that season through the British channel, and supply all Europe, as well as this bird, with their spoil. The gannet assiduously attends the shoal in their passage, keeps with them in their whole circuit round our island, and shares with our fishermen this exhaustless banquet. As it is strong of wing, it never comes near the land, but is constant to its prey. Wherever the gannet is seen, it is sure to announce to the fishermen the arrival of the finny tribe; they then prepare their nets, and take the herons by millions at a draught; while the gannet, who came to give the first information, comes, though an unbidden guest, and often snatches the prey from the fisherman even in his boat. While the fishing season continues, the gannets are busily employed; but when the pilchards disappear from our coasts, the gannet takes its leave to keep them company.

The cormorant has been remarked for the quickness of his sight; yet in this the gannet seems to exceed him. It is possessed of a transparent membrane under the eyelid, with which

it covers the whole eye at pleasure, without obscuring the sight in the smallest degree. This seems a necessary provision for the security of the eyes of so weighty a creature, whose method of taking its prey, like that of the cormorant, is by darting headlong down from a height of a hundred feet or more into the water to seize it.¹—These birds are sometimes taken at sea, by fastening a pilchard to a board, which they leave floating. The gannet instantly pounces down from above upon the board, and is killed or maimed by the shock of a body where it expected no resistance.²

¹ It is probable that more fish are caught in their congregated migrations, when the shoals are near the surface, than by their descent upon the wing; for the herrings, pilchards, mackerel, and other gregarious fishes, cannot at that time avoid their enemy, who is floating in the midst of profusion. In the act of respiration, there appears to be always some air propelled between the skin and the body of this bird, as a visible expansion and contraction is observed about the breast; and this singular conformation makes the bird so buoyant, that it floats high in the water, and not sunk beneath its surface, as observed in the cormorant and shag. The legs are not placed so far behind as in such of the feathered tribe as procure their subsistence by immersion. The gannet, consequently, has the centre of gravity placed more forward; and when standing, the body is nearly horizontal like a goose, and not erect like a cormorant. It is well known that many birds regurgitate with much ease and facility; and that instinct points out to them the necessity of preparing the food intended for the nourishment of their young, in the receptacle usually termed the craw; in this manner the gannet, having none, can easily disgorge the contents of its stomach to satisfy its young. By comparative anatomy it has been clearly demonstrated, that birds in general are provided with air-vessels in different parts of the body, and that many of their bones are not destitute of this contrivance, admirably fitted for increasing their lightness and consequent buoyancy, as well as progressive motion through that element in which they are intended principally to move. Mr. John Hunter proves, that the air-cells, in the parts already mentioned, have a free communication with the lungs, by means of openings on their surface, through which the air passes readily into them: and it clearly appears there is no diaphragm that confines the air to the regions or cavity of the breast, but that the whole of the abdomen is equally inflated by inspiration through the lungs. Thus far have the scientific researches of that anatomist contributed to our knowledge on this subject. No one appears to have noticed the phenomena attendant on the construction of the gannet, or to what farther extent this circulation of aerial fluid is carried in some particular species of birds. We cannot, however, withhold our highest admiration, when we contemplate the advantages of such a structure in conducing to the comforts, and perhaps to the very existence of such animals.

The gannet is capable of containing about three full inspirations of the human lungs, divided into nearly three equal portions, the cellular parts under the skin on each side holding nearly as much as the cavity of the body.—ED.

² Mr. Pennant says, that one of these birds flying over Penzance in Cornwall, saw some pilchards lying on a fir plank, where they had been placed for curing; and darting itself down with great violence, it stuck its bill quite through an inch and quarter plank: it was killed on the spot.—ED.

These birds breed but once a-year, and lay but one egg, which being taken away, they lay another; if that is also taken, then a third; but never more for that season. Their egg is white, and rather less than that of the common goose; and their nest large, composed of such substances as are found floating on the surface of the sea. The young birds, during the first year, differ greatly in colour from the old ones; being of a dusky hue, speckled with numerous triangular white spots; and at that time resembling the colours of the speckled diver.

The Bass island, where they chiefly breed, belongs to one proprietor; so that care is taken never to fright away the birds when laying, or to shoot them upon the wing. By that means, they are so confident as to alight and feed their young ones close beside you. They feed only upon fish, as was observed; yet the young gannet is counted a great dainty by the Scots, and is sold very dear; so that the lord of the islet makes a considerable annual profit by the sale.

CHAP. VI.

OF THE SMALLER GULLS AND PETRELS.

HAVING described the manners of the great ones of this tribe, those of the smaller kinds may be easily inferred. They resemble the more powerful in their appetites for prey, but have not such certain methods of obtaining it. In general, therefore, the industry of this tribe, and their audacity, increase in proportion to their imbecility; the great gulls live at the most remote distance from man; the smaller are obliged to reside wherever they can take their prey; and to come into the most populous places, when solitude can no longer grant them a supply. In this class we may place the Gull, properly so called, of which there are above twenty different kinds; the Petrel, of which there are three; and the Sea-swallow, of which there are as many. The gulls may be distinguished by an angular knob on the lower chap; the petrels by their wanting this knob; and the sea-swallow by their bills, which are straight, slender, and sharp-pointed. They all, however, agree in their appetites and their places of abode.

The gull, and all its varieties, is very well known in every part of the kingdom. It is seen with a slow-sailing flight, hovering over rivers to prey upon the smaller kinds of fish; it is seen following the ploughman in fallow fields to pick up insects; and when living animal food does not offer, it has even been known to eat carrion, and whatever else of the kind that offers. Gulls are found in great plenty in every place; but it is chiefly round our boldest rockiest shores that they are seen in the greatest abundance; it is

there that the gull breeds and brings up its young; it is there that millions of them are heard screaming with discordant notes for months together.

Those who have been much upon our coasts know that there are two different kinds of shores; that which slants down to the water with a gentle declivity, and that which rises with a precipitate boldness, and seems set as a bulwark to repel the force of the invading deeps. It is to such shores as these that the whole tribe of the gull-kind resort, as the rocks offer them a retreat for their young, and the sea a sufficient supply. It is in the cavities of these rocks, of which the shore is composed, that the vast variety of sea-fowls retire to breed in safety. The waves beneath, that continually beat at the base, often wear the shore into an impending boldness; so that it seems to jut out over the water, while the raging of the sea makes the place inaccessible from below. These are the situations to which sea-fowl chiefly resort, and bring up their young in undisturbed security.

Those who have never observed our boldest coasts, have no idea of their tremendous sublimity. The boasted works of art, the highest towers, and the noblest domes, are but ant-hills when put in comparison: the single cavity of a rock often exhibits a coping higher than the ceiling of a Gothic cathedral. The face of the shore offers to the view a wall of massive stone, ten times higher than our tallest steeples. What should we think of a precipice three quarters of a mile in height? and yet the rocks of St. Kilda are still higher! What must be our awe to approach the edge of that impending height, and to look down on the unfathomable vacuity below; to ponder on the terrors of falling to the bottom, where the waves that swell like mountains are scarcely seen to curl on the surface, and the roar of an ocean a thousand leagues broad appears softer than the murmur of a brook! it is in these formidable mansions that myriads of sea-fowls are for ever seen sporting, flying in security down the depth, half a mile beneath the feet of the spectator. The crow and the chough avoid those frightful precipices; they choose smaller heights, where they are less exposed to the tempest; it is the cormorant, the gannet, the tarrock, and the terne, that venture to these dreadful retreats, and claim an undisturbed possession. To the spectator from above, those birds, though some of them are above the size of an eagle, seem scarcely as large as a swallow; and their loudest screaming is scarcely perceptible.

But the generality of our shores are not so formidable. Though they may rise two hundred fathoms above the surface, yet it often happens that the water forsakes the shore at the departure of the tide, and leaves a noble and delightful walk for curiosity on the beach. Not to mention the variety of shells with which the sand is strewed, the lofty rocks that hang over the spec-

tator's head, and that seem but just kept from falling, produce in him no unpleasing gloom. If to this be added the fluttering, the screaming, and the pursuits of myriads of water-birds, all either intent on the duties of incubation, or roused at the presence of a stranger, nothing can compose a scene of more peculiar solemnity. To walk along the shore when the tide is departed, or to sit in the hollow of a rock when it is come in, attentive to the various sounds that gather on every side, above and below, may raise the mind to its highest and noblest exertions. The solemn roar of the waves swelling into and subsiding from the vast caverns beneath, the piercing note of the gull, the frequent chatter of the guillemot, the loud note of the auk, the scream of the heron, and the hoarse deep periodical croaking of the cormorant, all unite to furnish out the grandeur of the scene, and turn the mind to HIM who is the essence of all sublimity.

Yet it often happens that the contemplation of a sea-shore produces ideas of an humbler kind, yet still not unpleasing. The various arts of these birds to seize their prey, and sometimes to elude their pursuers, their society among each other, and their tenderness and care of their young, produce gentler sensations. It is ridiculous also now and then to see their various ways of imposing upon each other. It is common enough, for instance, with the arctic gull, to pursue the lesser gulls so long, that they drop their excrements through fear, which the hungry hunter quickly gobbles up before it ever reaches the water. In breeding too they have frequent contests; one bird who has no nest of her own, attempts to dispossess another, and puts herself in the place. This often happens among all the gull-kind: and I have seen the poor bird, thus displaced by her more powerful invader, sit near the nest in pensive discontent, while the other seemed quite comfortable in her new habitation. Yet this place of pre-eminence is not easily obtained; for the instant the invader goes to snatch a momentary sustenance, the other enters upon her own, and always ventures another battle before she relinquishes the justness of her claim. The contemplation of a cliff thus covered with hatching birds, affords a very agreeable entertainment; and as they sit upon the ledges of the rocks, one above another, with their white breasts forward, the whole group has not unaptly been compared to an apothecary's shop.

These birds, like all others of the rapacious kind, lay but few eggs; and hence, in many places, their number is daily seen to diminish. The lessening of so many rapacious birds may, at first sight, appear a benefit to mankind; but when we consider how many of the natives of our islands are sustained by their flesh, either fresh or salted, we shall find no satisfaction in thinking that these poor people may in time lose their chief support. The gull, in general, as was said, builds on the ledges of rocks, and lays from

one egg to three, in a nest formed of long grass and sea-weed. Most of the kind are fishy tasted, with black stringy flesh; yet the young ones are better food: and of these, with several other birds of the penguin kind, the poor inhabitants of our northern islands make their wretched banquets. They have been long used to no other food; and even salted gull can be relished by those who know no better. Almost all delicacy is a relative thing; and the man who repines at the luxuries of a well-served table, starves not for want, but from comparison. The luxuries of the poor are indeed coarse to us, yet still they are luxuries to those ignorant of better; and it is probable enough that a Kilda or a Feroe man may be found to exist, outdoing Apicius himself in consulting the pleasures of the table. Indeed, if it be true that such meat as is the most dangerously earned is the sweetest, no men can dine so luxuriously as these, as none venture so hardly in the pursuit of a dinner. In Jacobson's History of the Feroe islands, we have an account of the method in which those birds are taken; and I will deliver it in his own simple manner.

"It cannot be expressed with what pains and danger they take these birds in those high steep cliffs, whereof many are two hundred fathoms high. But there are men apt by nature, and fit for the work, who take them usually in two manners; they either climb from below into these high promontories, that are as steep as a wall; or they let themselves down with a rope from above. When they climb from below, they have a pole five or six ells long with an iron hook at the end, which they that are below in the boat, or on the cliff, fasten unto the man's girdle, helping him up thus to the highest place where he can get footing; afterwards they also help up another man; and thus several climb up as high as they possibly can; and, where they find difficulty, they help each other up, by thrusting one another up with their poles. When the first hath taken footing, he draws the other up to him, by the rope fastened to his waist; and so they proceed, till they come to the place where the birds build. They there go about as well as they can in those dangerous places, the one holding the rope at one end, and fixing himself to the rock; the other going at the other end from place to place. If it should happen that he chanceth to fall, the other that stands firm keeps him up, and helps him up again. But if he passeth safe, he likewise fastens himself till the other has passed the same dangerous place also. Thus they go about the cliffs after birds as they please. It often happeneth, however (the more is the pity), that when one doth not stand fast enough, or is not sufficiently strong to hold up the other in his fall, that they both fall down, and are killed. In this manner some do perish every year."

Mr. Peter Clanson, in his description of Norway, writes, that there was anciently a law in that

country, that whosoever climbed so on the cliffs that he fell down and died, if the body was found before burial, his next kinsman should go the same way; but if he durst not, or could not do it, the dead body was not then to be buried in sanctified earth, as the person was too full of temerity, and his own destroyer.

"When the fowlers are come, in the manner aforesaid, to the birds within the cliffs, where people seldom come, the birds are so tame, that they take them with their hands; for they will not readily leave their young. But when they are wild, they cast a net, with which they are provided, over them, and entangle them therein. In the meantime, there lieth a boat beneath in the sea, wherein they cast the birds killed; and, in this manner, they can in a short time fill a boat with fowl. When it is pretty fair weather, and there is good fowling, the fowlers stay in the cliff seven or eight days together; for there are here and there holes in the rocks, where they can safely rest; and they have meat let down to them with a line from the top of the mountain. In the meantime some go every day to them, to fetch home what they have taken.

"Some rocks are so difficult, that they can in no manner get unto them from below; wherefore they seek to come down thereunto from above. For this purpose they have a rope eighty or a hundred fathoms long, made of hemp, and three fingers thick. The fowler maketh the end of this fast about his waist, and between his legs, so that he can sit thereon; and is thus let down, with the fowling-staff in his hand. Six men hold by the rope, and let him easily down, laying a large piece of wood on the brink of the rock, upon which the rope glideth, that it may not be worn to pieces by the hard and rough edge of the stone. They have, besides, another small line, that is fastened to the fowler's body; on which he pulleth, to give them notice how they should let down the great rope, either lower or higher; or to hold still, that he may stay in the place whereunto he is come. Here the man is in great danger, because of the stones that are loosened from the cliff, by the swinging of the rope, and he cannot avoid them. To remedy this, in some measure, he hath usually on his head a seaman's thick and shaggy cap, which defends him from the blows of the stones, if they be not too big; and then it costeth him his life: nevertheless, they continually put themselves in that danger, for the wretched body's food sake, hoping in God's mercy and protection, unto which the greatest part of them do devoutly recommend themselves when they go to work: otherwise, they say, there is no other great danger in it, except that it is a toilsome and artificial labour; for he that hath not learned to be so let down, and is not used thereto, is turned about with the rope, so that he soon groweth giddy, and can do nothing; but he that hath learned the art, considers it as a sport, swings himself on the rope,

sets his feet against the rock, casts himself some fathoms from thence, and shoots himself to what place he will: he knows where the birds are, he understands how to sit on the line in the air, and how to hold the fowling-staff in his hand; striking therewith the birds that come or fly away; and when there are holes in the rocks, and it stretches itself out, making underneath as a ceiling under which the birds are, he knoweth how to shoot himself in among them, and there take firm footing. There, when he is in these holes, he maketh himself loose of the rope, which he fastens to a crag of the rock, that it may not slip from him to the outside of the cliff. He then goes about in the rock, taking the fowl either with his hands or with the fowling-staff. Thus, when he hath killed as many birds as he thinks fit, he ties them in a bundle, and fastens them to a little rope, giving a sign, by pulling, that they should draw them up. When he has wrought thus the whole day, and desires to get up again, he sitteth once more upon the great rope, giving a new sign that they should pull him up; or else he worketh himself up, climbing along the rope, with his girdle full of birds. It is also usual, where there are not folks enough to hold the great rope, for the fowler to drive a post sloping into the earth, and to make a rope fast thereto, by which he lets himself down without any body's help, to work in the manner aforesaid. Some rocks are so formed that the person can go into their cavities by land.

"These manners are more terrible and dangerous to see than to describe; especially if one considers the steepness and height of the rocks, it seeming impossible for a man to approach them, much less to climb or descend. In some places the fowlers are seen climbing where they can only fasten the ends of their toes and fingers; not shunning such places, though there be a hundred fathom between them and the sea. It is a dear meat for these poor people, for which they must venture their lives; and many, after long venturing, do at last perish therein.

"When the fowl is brought home, a part thereof is eaten fresh; another part, when there is much taken, being hung up for winter provision. The feathers are gathered to make merchandise of, for other expenses. The inhabitants get a great many of these fowls, as God giveth his blessing and fit weather. When it is dark and hazy they take most; for then the birds stay in the rocks: but in clear weather and hot sunshine they seek the sea. When they prepare to depart for the season, they keep themselves most there, sitting on the cliffs towards the sea-side, where people get at them sometimes with boats, and take them with fowling-staves."

Such is the account of this historian; but we are not to suppose that all the birds caught in this manner are of the gull kind: on the contrary, numbers of them are of the penguin kind; auks, puffins, and guillemots. These all come,

once a season, to breed in these recesses; and retire in winter to fish in more southern climates.

SUPPLEMENTARY NOTE.

The *Petrels* have received this denomination whimsically enough. Besides the faculty of swimming, they possess that of supporting themselves on the water, by striking very rapidly with their feet, which has caused them to be compared to St. Peter walking upon the water. The petrels are to be seen in all seas of the globe from one pole to the other. They are the inseparable companions of mariners during their long navigations. The flight of these birds is almost always performed by hovering, and without presenting apparent vibrations. They rise with facility, and can fly against the strongest winds, which never slacken their movements. The tempest not only does not affright them, but they are almost necessitated to seek those seas where the agitation of the waves brings to the surface those marine animals which constitute their food. In consequence of this, they are frequently seen in all weathers, in the vortices which are formed by the track of vessels. "It is indeed an interesting sight," says Wilson, "to observe these little birds, in a gale, coursing over the waves, down the declivities, and up the ascents of the foaming surf that threatens to burst over their heads, sweeping along the hollow troughs of the sea as in a sheltered valley, and again mounting with the rising billow, and just above its surface, occasionally dropping their feet, which, striking the water, throw them up again with additional force, sometimes leaping, with both legs parallel, on the surface of the roughest waves for several yards at a time. Meanwhile they continue coursing from side to side of the ship's wake, making excursions far and wide to the right and to the left, now a great way ahead, and now shooting astern for several hundred yards, returning again to the ship as if she were all the while stationary, though perhaps running at the rate of ten knots an hour. But the most singular peculiarity of this bird is its faculty of standing, and even running on the surface of the water, which it performs with apparent facility. When any greasy matter is thrown overboard, these birds instantly collect around it, facing to windward, with their long wings expanded and their webbed feet patting the water. The lightness of their bodies, and the action of the wind on their wings, enable them with ease to assume this position. In calm weather they perform the same manœuvre by keeping their wings just so much in action as to prevent their feet from sinking below the surface."

"There are," says the same writer in another place, "few persons who have crossed the Atlantic that have not observed these solitary wanderers of the deep, skimming along the surface of the wild and wasteful ocean; flitting past the vessel like swallows, or following in her wake, gleaning their scanty pittance of food from the rough and whirling surges. Habited in mourning, and making their appearance generally in greater numbers previous to or during a storm, they have long been fearfully regarded by the ignorant and superstitious, not only as the foreboding messengers of tempests and dangers to the hapless mariner, but as wicked agents, connected somehow or other in creating them. 'Nobody,' say they, 'can tell anything of where they come from, or how they breed, though (as sailors sometimes say) it is supposed that they hatch their eggs under their wings as they sit on the water.' This mysterious uncertainty of their origin, and the circumstances above recited, have doubtless given rise to the opinion, so prevalent among this class of men, that they are in some way or other connected with

the prince of the power of the air. In every country where they are known, their names have borne some affinity to this belief. They have been called witches, stormy petrels, the Devil's birds, and Mother Cary's chickens, probably from some celebrated ideal hag of that name; and their unexpected and numerous appearance has frequently thrown a momentary damp over the mind of the hardiest seaman. It is the business of the naturalist, and the glory of philosophy, to examine into the reality of these things; to dissipate the clouds of error and superstition wherever they darken and bewilder the human understanding, and to illustrate nature with the radiance of truth."

When we inquire, accordingly, into the unvarnished history of this ominous bird, we find that it is by no means peculiar in presaging storms, for many others of very different families are evidently endowed with an equally nice perception of a change in the atmosphere. Hence it is that, before rain, swallows are seen more eagerly hawking for flies, and ducks carefully trimming their feathers, and tossing up water over their backs, to try whether it will run off again without wetting them. But it would be as absurd to accuse the swallows and ducks on that account of being the cause of rain, as to impute a tempest to the spiteful malice of the poor petrels. Seamen ought rather to be thankful to them for the warning which their delicate feelings of aerial change enable them to give of an approaching hurricane. "As well," says Wilson, "might they curse the midnight lighthouse that, star-like, guides them on their watery way; or the buoy that warns them of the sunken rocks below, as this harmless wanderer, whose manner informs them of the approach of the storm, and thereby enables them to prepare for it." The petrels are nocturnal birds. When, therefore, they are seen flying about and feeding by day, the fact appears to indicate that they have been driven from their usual quarters by a storm; and hence perhaps, arose the association of the bird with the tempest. Though the petrels venture to wing their way over the wide ocean, as fearlessly as our swallows do over a mill-pond, they are not, therefore, the less sensible to danger; and, as if feelingly aware of their own weakness, they make all haste to the nearest shelter. When they cannot then find an island or a rock to shield them from the blast, they fly towards the first ship they can desery, crowd into her wake, and even close under the stern, heedless, it would appear, of the rushing surge, so that they can keep the vessel between them and the unbroken sweep of the wind. It is not to be wondered at, in such cases, that their low wailing note of *weel, weel*, should add something supernatural to the roar of waves and whistling of the wind, and infuse an ominous dread into minds prone to superstition.

The popular opinion among sailors, that the petrels carry their eggs under their wings in order to hatch them, is no less unfounded than the fancy of their causing storms: it is, indeed, physically impossible. On the contrary, the petrels have been ascertained to breed on rocky shores, in numerous communities, like the bank-swallow, making their nests in the holes and cavities of the rocks above the sea, returning to feed their young only during the night, with the superabundant oily food from their stomachs. The quantity of this oily matter is so considerable, that, in the Faro Isles, they use petrels for candles, with no other preparation than drawing a wick through the body of the birds from the mouth to the rump. While nestling, they make a clattering or croaking noise, similar to frogs, which may be heard during the whole night on the shores of the Bahama and Bermuda Islands, and the coasts of Cuba and Florida, where they abound. Forster says they bury themselves by thousands in holes under ground, where

they rear their young and lodge at night; and at New Zealand, the shores resound with the noise, similar to the clucking of hens, or the croaking of frogs (Pontoppidan, speaking of those of Norway, says like the neighing of a horse), which they send forth from their concealment.

The *Gulls*, Buffon terms the vultures of the sea, for they feed upon carcasses of every description, which are either floating on its surface, or cast upon its shores. They swarm upon the borders of the sea, where they seek fish, either fresh or corrupted, flesh in the same states, worms, or mollusca, all of which their stomach is capable of digesting. Spread throughout the entire globe, they cover with their multitudes the shores, rocks, and cliffs, causing them to re-echo with their clamours. There are even some species which frequent the fresh-waters, and some are to be met with at sea, at more than a hundred leagues distant from land. D'Azara, who has seen them, in innumerable quantities, near the slaughter-houses of Monte Video, Buenos Ayres, and even in the squares, where they pick up the offal of the shambles, &c., and sometimes perch on the roofs, tells us that they proceed considerably to inland, whither they are attracted by dead animals.

They dart with such violence on their prey, that they will swallow both bait and hook, and spit themselves on the point placed by the fisher under the fish which he presents to them. It is, therefore, very natural that they should pursue individuals of their own species, in whose possession they see any food, a fact, moreover, of which we are constant eye-witnesses in other species, such as sparrows, hens, &c. Gulls have been found by navigators in all latitudes; they are, however, both more numerous and larger in the northern regions, where the carcasses of large fishes and cetacea present them with more abundant food, and it is on the desert islands of the two polar zones, where they are undisturbed, that they prefer to nestle. They deposit their eggs either in a hole upon the sand, or in the crevices of rocks; but in less deserted countries the smaller species seek the borders of waters, or of the sea, which are covered with plants.

The *Skua gull* is nearly two feet in length, and weighs about three pounds. Its bill is two inches and a quarter long, hooked at the end and very sharp; and the upper mandible is covered more than half way down, with a black cere or skin, as in the hawk kind. The feathers of the upper parts of the body are of a deep brown, but below they are somewhat of a rust colour. The talons are black, strong, and crooked. The skua gull inhabits Norway, the Faroe islands, and other parts of the north of Europe. It is the most formidable bird of the tribe, its prey being not only fish, but—what is wonderful in a web-footed bird—all the lesser sorts of water-fowl. Mr. Schroter, a surgeon of the Faroe islands, says they feed even on ducks, poultry, and young lambs. This gull has the fierceness of the eagle in defending its offspring. When the inhabitants of those islands visit the nest, it attacks them with such force, that, if they hold a knife perpendicularly over their heads, the gull will sometimes transfix itself upon it, in descending to take revenge on the plunderers. The Rev. Mr. Lowe, minister of Birsá, in Orkney, informs us, that on his approaching the habitations of these birds, they assailed him, and the company along with him, in the most violent manner; and intimidated a bold dog in such a way as to drive him from the protection of his master. The natives are often very rudely treated by them, while they are attending their cattle on the hills; and they are frequently obliged to guard their heads by holding up their sticks, on which—in the manner mentioned above—the birds often kill themselves. In Foula, the skua gulls are privileged, being said to defend the flocks

from the attacks of the eagle, which they beat off and pursue with great fury; so that even that rapacious bird seldom ventures to approach the places which they inhabit. The natives of Foula, on this account, impose a fine upon any person who destroys one of these useful defenders: and deny that they ever injure their flocks or poultry, imagining them to live only on the dung of the arctic gull and other larger birds.

The *Common gull* generally measures between sixteen and seventeen inches in length, thirty-six and sometimes more in breadth, and weighs about one pound. The bill is pale yellow, tinged with green, and an inch and three quarters long; irides hazel; edges of the eyelids red: the upper part of the head and cheeks, and the back part of the neck are streaked with dusky spots: the back scapulars and wings are of a fine pale bluish gray; the throat, rump, and all the under parts pure white; the first two quills are black, with a pretty large spot of white at their tips, the next four are tipped with black, and the secondaries largely with white; the legs are greenish or dirty white. This species breeds on rocky cliffs; and lays two eggs nearly the size of that of a hen, of an olive-brown colour, marked with dark reddish blotches, or irregular spots. Some persons who live near the coast eat this bird, as well as various other species of gulls, which they describe as good food when they have undergone a certain sweetening process before cooking, such as burying them in fresh mould for a day, or washing them in vinegar.

Mr. Scott, of Benholm, near Montrose, many years ago caught a sea-gull, whose wings he cut, and put it into a walled garden, for the purpose of destroying slugs, of which these birds are very fond. It thrived remarkably well in this situation, and remained about the place for several years. The servants were much attached to this animal, and it became so familiar, that it came at their call to the kitchen door to be fed; and answered to the name of Willie. At length it became so domesticated, that no pains were taken to keep its wings cut; and having at last acquired their full plume, it flew away and joined the other gulls on the beach; and occasionally paid a visit to its old quarters. At the time the gulls annually leave that part of the coast, Willie also took his departure along with them, to the no small regret of the family, who were much attached to him. Next season, however, Willie again made his appearance, and visited the delighted family of Mr. Scott with his wonted familiarity. They took care to feed him well, to induce him if possible to become a permanent resident. But all would not do, for he annually left Benholm. This practice he regularly continued, for the extraordinary length of forty years, without intermission, and seemed to have much pleasure in this friendly intercourse. While he remained on that part of the coast, he usually paid daily visits to his friends at Benholm, answered to his name, and even fed out of their hands. One year the gulls appeared on the coast, at their ordinary time, but Willie did not, as was usual, pay his respects immediately on reaching that neighbourhood, from which they concluded that their favourite visitant was numbered with the dead, which caused them much sorrow. About ten days after, during breakfast, a servant entered the room exclaiming that Willie had returned. The overjoyed family, one and all of them, ran out to welcome Willie; an abundant supply of food was set before him, and he partook of it with his former frankness, and was as tame as a domestic fowl. In about two years afterwards, this bird disappeared for ever. The above fact is confirmatory of the great age which the gull has been said to attain.

The common sea-gull is very voracious: two of these birds which run in the grounds of General Ramsay, at Canterbury, devoured in one day fourteen

and two rats; and one of them lately swallowed a very large rat, whole. The bird made several attempts to gorge the animal, and at length succeeded, to the astonishment of the bystanders; the tail was visible for several minutes.

The *Black-headed gull* measures fifteen inches in length, and thirty-six in breadth, and weighs about ten ounces. The head is black, but in some individuals inclining to a mouse-coloured brown; the back and wings are of a delicate pale lead, or ash-colour; the neck, tail, and all the under parts pure white.

The black-headed gulls breed on the marshy edges of rivers, lakes, and fens, in the interior parts of the country. The female makes her nest among the reeds and bushes, of heath and dried grass, and lays three or four eggs of an olive-brown colour, blotched all over with spots and streaks of dull rusty red. As soon as the young ones are able to accompany them, they all retire from those places, and return to the sea. In former times these birds were looked upon as valuable property, by the owners of several fens and marshes in this country, who every autumn caused the little islets, in these wastes, to be cleared of the reeds and rushes, in order properly to prepare the spots for the reception of the old birds in the spring, to which places at that season they regularly returned in great flocks to breed. The young ones were then highly esteemed as excellent eating, and were caught in great numbers before they were able to fly. Six, or even seven men, equipped for this business, waded through the pools, and with long staves, drove them to the land, against nets placed upon the shore of those hafts, where they were easily caught by the hand, and put into pens ready prepared for their reception. The gentry assembled from all parts to see the sport. Dr. Plot, in his 'Natural History of Staffordshire,' published in 1686, says, that in the manner above described, as many have been caught in one morning as produced the sum of twelve pounds ten shillings; and at that time they sold for five shillings a-dozen. He states, that in the several drifts on the few days of this sport, they have been taken in some years in such abundance, that their value, according to the above rate, was from thirty to sixty pounds,—a great sum in those days. These are the sea-gulls of which we read as being so plentifully provided at the great feasts of the ancient nobility and bishops of this realm. Although the flesh of these birds is not now esteemed as a dainty, and they are seldom sought after as an article of food, yet in the breeding season, when accommodation and protection are afforded them, they still regularly resort to the same old haunts, which have been occupied by their kind for a long time past.

Dr. Plot describes them as coming annually "to certain pools on the estate of the right worshipful Sir Charles Skrymsher, knight, to build and breed, and to no other estate but that of this family, in or near the county, to which they have belonged beyond the memory of man, and never moved from it, though they have changed their station often." What the doctor relates of the attachment of these birds to the head of that family, of their removal to another spot immediately on his death, and of their returning again with the same predilection to his heir, is curious enough, although bordering very much upon the marvellous. Willoughby gives very nearly the same account, and computes the sale of the birds at twenty-five pounds per annum.

The *Terns* have been also called *Sea-swallows*, from the resemblance of their forked tail, long wings, and their constant habit of shaving the surface of the water in all directions, in pursuit of small fish. But the term is exceedingly objectionable, as tending to the inter-confusion of birds of such different orders,

and such essential differences of conformation and habits. The terns are continually on the wing, and though web-footed, are not seen to swim; they rest but seldom, and only on the land; their food consists, for the most part, in small fishes and mollusca, which they seize upon the surface of the water; but they also catch aerial insects. In flying they send forth sharp and piercing cries, especially during nestling time. In calm weather they sometimes rise very high, and are often seen to come plump down. The young differ from the adult and aged, only before the moulting, which is double in the known species, and there is no external difference between the two sexes. The females deposit their eggs, usually two or three in number, in a cavity, and these nests are sometimes so close, that the sitting birds touch each other. Terns are found in both continents, from the seas, lakes, and rivers of the north, as far as the vast coasts of the Austral ocean, and in almost all the intermediate climates.

CHAP. VII.

OF THE PENGUIN KIND; AND FIRST, OF THE GREAT MAGELLANIC PENGUIN.

THE gulls are long-winged, swift fliers, that hover over the most extensive seas, and dart down upon such fish as approach too near the surface. The penguin kind are but ill fitted for flight, and still less for walking. Everybody must have seen the awkward manner in which a duck, either wild or tame, attempts to change place: they must recollect with what softness and ease a gull or a kite waves its pinions, and with what a coil and flutter the duck attempts to move them; how many strokes it is obliged to give, in order to gather a little air; and even when it is thus raised, how soon it is fatigued with the force of its exertions, and obliged to take rest again. But the duck is not, in its natural state, half so unwieldy an animal as the whole tribe of the penguin kind. Their wings are much shorter, more scantily furnished with quills, and the whole pinion placed too forward to be usefully employed. For this reason, the largest of the penguin kind, that have a thick heavy body to raise, cannot fly at all. Their wings serve them rather as paddles to help them forward, when they attempt to move swiftly, and in a manner walk along the surface of the water. Even the smallest kinds seldom fly by choice; they flutter their wings with the swiftest efforts without making way; and though they have but a small weight of body to sustain, yet they seldom venture to quit the water, where they are provided with food and protection.

As the wings of the penguin tribe are unfitted for flight, their legs are still more awkwardly adapted for walking. This whole tribe have all above the knee hid within the belly: and nothing appears but two short legs, or feet, as some would call them, that seem stuck under the rump, and upon which the animal is very awkwardly sup-

ported. They seem, when sitting, or attempting to walk, like a dog that has been taught to sit up, or to move a minuet. Their short legs drive the body in progression from side to side; and were they not assisted by their wings, they would scarcely move faster than a tortoise.

This awkward position of the legs, which so unqualifies them for living upon land, adapts them admirably for a residence in water. In that, the legs placed behind the moving body, pushes it forward with the greater velocity; and these birds, like Indian canoes, are the swiftest in the water, by having their paddles in the rear. Our sailors, for this reason, give these birds the very homely, but expressive, name of *arae-fect*.

Nor are they less qualified for diving than for swimming. By ever so little inclining their body forward, they lose their centre of gravity; and every stroke from their feet only tends to sink them the faster. In this manner they can either dive at once to the bottom, or swim between two waters; where they continue fishing for some minutes, and then ascending, catch an instantaneous breath, to descend once more to renew their operations. Hence it is, that these birds, which are so defenceless, and so easily taken by land, are impregnable by water. If they perceive themselves pursued in the least, they instantly sink, and show nothing more than their bills, till the enemy is withdrawn. Their very internal conformation assists their power of keeping long under water. Their lungs are fitted with numerous vacuities, by which they can take in a very large inspiration; and this probably serves them for a length of time.

As they never visit land except when they come to breed, their feathers take a colour from their situation. That part of them which has been continually bathed in the water, is white; while their backs and wings are of different colours, according to the different species. They are also covered more warmly all over the body with feathers than any other birds whatever; so that the sea seems entirely their element: and but for the necessary duties of propagating their species, we should scarcely have the smallest opportunity of seeing them, and should be utterly unacquainted with their history.

Of all this tribe, the Magellanic penguin is the largest, and the most remarkable. In size it approaches near that of a tame goose. It never flies, as its wings are very short, and covered with stiff hard feathers, and are always seen expanded, and hanging uselessly down by the bird's sides. The upper part of the head, back, and rump, are covered with stiff black feathers; while the belly and breast, as is common with all of this kind, are of a snowy whiteness, except a line of black that is seen to cross the crop. The bill, which from the base to about half way is covered with wrinkles, is black, but marked crosswise with a stripe of yellow. They walk

erect, with their heads on high, their fin-like wings hanging down like arms; so that to see them at a distance, they look like so many children with white aprons. From hence they are said to unite in themselves the qualities of men, fowls, and fishes. Like men, they are upright; like fowls, they are feathered; and like fishes, they have fin-like instruments, that beat the water before, and serve for all the purposes of swimming rather than flying.

They feed upon fish; and seldom come ashore, except in the breeding season. As the seas in that part of the world abound with a variety, they seldom want food; and their extreme fatness seems a proof of the plenty in which they live. They dive with great rapidity, and are voracious to a great degree. One of them, described by Clusius, though but very young, would swallow an entire herring at a mouthful, and often three successively before it was appeased. In consequence of this gluttonous appetite, their flesh is rank and fishy; though our sailors say, that *it is pretty good eating*. In some the flesh is so tough, and the feathers so thick that they stand the blow of a scimitar without injury.

They are a bird of society; and, especially when they come on shore, they are seen drawn up in rank and file, upon the ledge of a rock, standing together with the albatross, as if in consultation. This is previous to their laying, which generally begins, in that part of the world, in the month of November. Their preparations for laying are attended with no great trouble, as a small depression in the earth, without any other nest, serves for this purpose. The warmth of their feathers and the heat of their bodies is such, that the progress of incubation is carried on very rapidly.

But there is a difference in the manner of this bird's nestling in other countries, which I can only ascribe to the frequent disturbances it has received from man or quadrupeds in its recesses. In some places, instead of contenting itself with a superficial depression in the earth, the penguin is found to burrow two or three yards deep; in other places it is seen to forsake the level, and to clamber up the ledge of a rock, where it lays its egg, and hatches it in that bleak exposed situation. These precautions may probably have been taken in consequence of dear-bought experience. In those places where the bird fears for her own safety or that of her young, she may providentially provide against danger, by digging, or even by climbing; for both which she is but ill-adapted by nature. In those places, however, where the penguin has had but few visits from man, her nest is made, with the most confident security, in the middle of some large plain, where they are seen by thousands. In that unguarded situation, neither expecting nor fearing a powerful enemy, they continue to sit brooding; and even when man comes among them, have at first no apprehension of their dan-

ger. Some of this tribe have been called by our seamen, *the Booby*, from the total insensibility which they show when they are sought to their destruction. But it is not considered that these birds have never been taught to know the dangers of a human enemy: it is against the fox or the vulture that they have learned to defend themselves: but they have no idea of injury from a being so very unlike their natural opposers. The penguins, therefore, when our seamen first came among them, tamely suffered themselves to be knocked on the head, without even attempting an escape. They have stood to be shot at in flocks, without offering to move, in silent wonder, till every one of their number has been destroyed. Their attachment to their nests was still more powerful; for the females tamely suffered the men to approach and take their eggs without any resistance. But the experience of a few of these unfriendly visits has long since taught them to be more upon their guard in choosing their situations, or to leave those retreats where they were so little able to oppose their invaders.

The penguin lays but one egg; and, on frequented shores, is found to burrow like a rabbit: sometimes three or four take possession of one hole, and hatch their young together. In the holes of the rocks, where nature has made them a retreat, several of this tribe, as Linnaeus assures us, are seen together. There the females lay their single egg, in a common nest, and sit upon this, their general possession, by turns; while one is placed as a sentinel, to give warning of approaching danger. The egg of the penguin, as well as of all this tribe, is very large for the size of the bird, being generally found bigger than that of a goose. But as there are many varieties of the penguin, and as they differ in size, from that of a Muscovy duck to a swan, the eggs differ in the same proportion.

SUPPLEMENTARY NOTE.

The *Crested penguin*, which is the most beautiful of the penguin tribe, is nearly two feet in length. The bill is red, and three inches long; the upper mandible curved at the end, and the lower obtuse. The head, neck, back, and sides, are black. Over each eye there is a stripe of pale yellow feathers, which lengthens into a crest about four inches long; this is decumbent, but can be erected at pleasure: the feathers of the head above this are longer than the rest, and stand upward. The wings are black on the outside, but the edges and the inside are white. The legs are orange-coloured, and the claws dusky. The female is destitute of the crest. These birds have also the names of hopping penguins, and jumping jack, from their action of leaping quite out of the water, sometimes three or four feet, on meeting with any obstacle in their course; and, indeed, they frequently do this without any other apparent cause than the desire of advancing by that means. They are inhabitants of several of the South Sea islands.

This species seems to have a greater air of liveliness in its countenance than almost any of the others; yet it is a very stupid bird, and so regardless of its

own safety as even to suffer any person to lay hold of it. When provoked it erects its crest in a very beautiful manner; and when attacked by our voyagers, we are told it ran at them in flocks, pecked their legs, and spoiled their clothes. Mr. Forster, in his account of one of the South Sea islands, says, "When the whole herd was beset, they all became very bold at once, and ran violently at us, biting our legs, or any part of our clothes." They are very tenacious of life. Mr. Forster left a great number of them apparently lifeless, from the blows they had received, while he went in pursuit of others; but they all afterwards got up, and marched off with the utmost gravity. Their sleep is extremely sound; for Dr. Sparrman, accidentally stumbling over one of them, kicked it several yards, without disturbing its rest; nor was it till after being repeatedly shaken that the bird awoke.

The crested penguins form their nests among those of the birds of the pelican tribe, and live in tolerable harmony with them. The female generally lays only a single egg. Their nests are holes in the earth, which they easily form with their bills, throwing back the dirt with their feet. They are often found in great numbers on the shores where they have been bred.

Perrin, in his 'Account of an expedition to the Falkland islands in 1772,' mentions a species of penguin that resorts to certain places of these islands in incredible numbers, and lays its eggs. These places, he says, had become, by its long residence, entirely freed from grass; and has given to them the name of towns. These nests were composed of mud, raised into hillocks about a foot high, and placed close to each other. "Here," he adds, "during the breeding season, we were presented with a sight that conveyed a most dreary, and I may say awful idea of the desertion of the islands by the human species: general stillness prevailed in these towns; and whenever we took our walks among them, in order to provide ourselves with eggs, we were regarded indeed with sidelong glances, but we carried no terror with us. The eggs are rather larger than those of a goose, and are laid in pairs. When we took them once, and sometimes twice in a season, they were as often replaced by the birds; but prudence would not permit us to plunder too far, lest a future supply, in the next year's brood, might be prevented."

The *Patagonian penguin* inhabits the Falkland islands and New Guinea; is four feet three inches long. The bill and legs are black; and the ears have a golden spot: lower mandible tawny at the base; irides hazel; the head and hind part of the neck are brown; the back is of a black-blue colour; the breast, belly, and vent, are white.

Mr. G. Bennett, in a note read at the Zoological society, on the habits of this bird, as observed by him on various occasions when in high southern latitudes, described particularly a colony of penguins, which covers an extent of thirty or forty acres, at the north end of Macquarrie island, in the South Pacific ocean. The number collected together in this spot is immense, but it would be almost impossible to guess at it with any near approach to truth, as, during the whole of the day and night, 30,000 or 40,000 of them are continually landing, and an equal number going to sea. They are arranged, when on shore, in as compact a manner and in as regular ranks as a regiment of soldiers; and are classed with the greatest order, the young birds being in one situation, the moulting birds in another. The sitting hens in a third, the clean birds in a fourth, &c.; and so strictly do birds in similar condition congregate, that should a bird that is moulting intrude itself among those which are clean, it is immediately ejected from among them. The females hatch the eggs by keeping them close between their thighs; and, if

approached during the time of incubation, move away, carrying the eggs with them. At this time the male bird goes to sea and collects food for the female, which becomes very fat. After the young is hatched, both parents go to sea, and bring home food for it; it soon becomes so fat as scarcely to be able to walk, the old birds getting very thin. They sit quite upright in their roosting-places, and walk in the erect position until they arrive at the beach, when they throw themselves on their breasts, in order to encounter the very heavy sea met with at their landing-place. Although the appearance of penguins generally indicates the neighbourhood of land, Mr. G. Bennett cited several instances of their occurrence at a considerable distance from any known land.

The *Manchots* bear a close relation to the penguins, but are found only in the Antarctic seas and islands, while the penguins inhabit the northern seas. Instead of wings, they have simple winglets, which perform the office of oars or fins.

CHAP. VIII.

OF THE AUK, PUFFIN, AND OTHER BIRDS OF THE PENGUIN KIND.

Of a size far inferior to the penguin, but with nearly the same form, and exactly of the same appetites and manners, there is a very numerous tribe. These frequent our shores, and, like the penguin, have their legs placed behind. They have short wings, which are not totally incapable of flight; with round bills for seizing their prey, which is fish. They live upon the water, in which they are continually seen diving; and seldom venture upon land, except for the purposes of continuing their kind.

The first of this smaller tribe is the Great Northern Diver, which is nearly the size of a goose: it is beautifully variegated all over with many strips, and differs from the penguin in being much slenderer, and more elegantly formed. The Gray Speckled Diver does not exceed the size of a Muscovy duck; and, except in size, greatly resembles the former. The Auk, which breeds on the islands of St. Kilda, chiefly differs from the penguin in size and colour: it is smaller than a duck; and the whole of the breast and belly, as far as the middle of the throat, is white. The Guillemot is about the same size; it differs from the auk, in having a longer, slenderer, and a straighter bill. The Scarlet-throated Diver may be distinguished by its name: and the Puffin, or Coulterneb, is one of the most remarkable birds we know.

Words cannot easily describe the form of the bill of the puffin, which differs so greatly from that of any other bird. Those who have seen the coulter of a plough, may form some idea of the beak of this odd-looking animal. The bill is flat; but, very different from that of a duck, its edge is upwards: it is of a triangular figure, and ending in a sharp point, the upper chap bent a little downward, where it is joined to the head; and a

certain callous substance encompassing its base, as in parrots. It is of two colours; ash-coloured near the base, and red towards the point. It has three furrows or grooves impressed in it; one in the livid part, two in the red. The eyes are fenced with a protuberant skin, of a livid colour; and they are gray or ash-coloured. These are marks sufficient to distinguish this bird by; but its value to those in whose vicinity it breeds renders it still more an object of curiosity.

The puffin, like all the rest of its kind, has its legs thrown so far back, that it can hardly move without tumbling. This makes it rise with difficulty, and subject to many falls before it gets upon the wing: but as it is a small bird, not much bigger than a pigeon, when it once rises, it can continue its flight with great celerity.

Both this and all the former build no nest; but lay their eggs either in the crevices of rocks, or in holes under ground near the shore. They chiefly choose the latter situation; for the puffin, the auk, the guillemot, and the rest, cannot easily rise to the nest when in a lofty situation. Many are the attempts these birds are seen to make to fly up to those nests which are so high above the surface. In rendering them inaccessible to mankind, they often render them almost inaccessible to themselves. They are frequently obliged to make three or four efforts, before they can come at the place of incubation. For this reason, the auk and guillemot, when they have once laid their single egg, which is extremely large for the size, seldom forsake it until it is excluded. The male, who is better furnished for flight, feeds the female during this interval; and so bare is the place where she sits, that the egg would often roll down from the rock, did not the body of the bird support it.

But the puffin seldom chooses these inaccessible and troublesome heights for its situation. Relying on its courage and the strength of its bill, with which it bites most terribly, it either makes or finds a hole in the ground, where to lay and bring forth its young. All the winter these birds, like the rest, are absent; visiting regions too remote for discovery. At the latter end of March, or the beginning of April, come over a troop of their spies or harbingers, that stay two or three days, as it were to view and search out for their former situations, and see whether all be well. This done, they once more depart; and about the beginning of May, return again with the whole army of their companions. But if the season happens to be stormy and tempestuous, and the sea troubled, the unfortunate voyagers undergo incredible hardships; and they are found by hundreds cast away upon the shores, lean and perished with famine.¹ It is most probable, therefore, that this voyage is performed more on the water than in the air; and as they cannot fish in stormy weather, their strength is

¹ Willoughby's Ornith. p. 326.

exhausted before they can arrive at their wished-for harbour.

The puffin, when it prepares for breeding, which always happens a few days after its arrival, begins to scrape up a hole in the ground not far from the shore; and when it has some way penetrated the earth, it then throws itself upon its back, and with bill and claws thus burrows inward, till it has dug a hole with several windings and turnings, from eight to ten feet deep. It particularly seeks to dig under a stone, where it expects the greatest security. In this fortified retreat it lays one egg; which, though the bird be not much bigger than a pigeon, is of the size of a hen's.

When the young one is excluded, the parent's industry and courage is incredible. Few birds or beasts will venture to attack them in their retreats. When the great sea-raven, as Jacobson informs us, comes to take away their young, the puffins boldly oppose him. Their meeting affords a most singular combat. As soon as the raven approaches, the puffin catches him under the throat with its beak, and sticks its claws into its breast, which makes the raven, with a loud screaming, attempt to get away; but the little bird still holds fast to the invader, nor lets him go till they both come to the sea, where they drop down together, and the raven is drowned; yet the raven is but too often successful; and, invading the puffin at the bottom of its hole, devours both the parent and its family.

But were a punishment to be inflicted for immorality in irrational animals, the puffin is justly a sufferer from invasion, as it is often itself one of the most terrible invaders. Near the isle of Anglesey, in an islet called Priestholm, their flocks may be compared, for multitude, to swarms of bees. In another islet, called the Calf of Man, a bird of this kind, but of a different species, is seen in great abundance. In both places, numbers of rabbits are found to breed; but the puffin, unwilling to be at the trouble of making a hole, when there is one ready made, dispossesses the rabbits, and it is not unlikely destroys their young.² It is in these unjustly acquired retreats

² "In the breeding season," says Mr. Rennie, "numerous troops of them visit several places on our coasts, particularly the small island of Priestholm, near Anglesey, which might well be called puffin land, as the whole surface appears literally covered with them. Soon after their arrival in May, they prepare for breeding, and it is said, the male, contrary to the usual economy of birds, undertakes the hardest part of the labour. He begins by scraping up a hole in the sand not far from the shore; and after having got some depth, he throws himself on his back, and with his powerful bill as a digger and his broad feet to remove the rubbish, he excavates a burrow with several windings and turnings, from eight to ten feet deep. He prefers, where he can find a stone, to dig under it, in order that his retreat may be more securely fortified. Whilst thus employed, the birds are so intent upon their work that they are easily caught by the hand. This bird, like others which burrow in similar localities, is ac-

that the young puffins are found in great numbers, and become a very valuable acquisition to the natives of the place. The old ones (I am now speaking of the Manks puffin) early in the morning, at break of day, leave their nests and young, and even the island, nor do they return till night-fall. All this time they are busily employed in fishing for their young; so that their retreats on land, which in the morning were loud and clamorous, are now still and quiet, with not a wing stirring till the approach of dusk, when their screams once more announce their return. Whatever fish, or other food, they have procured in the day, by night begins to suffer a half digestion, and is reduced to an oily matter, which is ejected from the stomach of the old ones into the mouth of the young. By this they are nourished, and become fat to an amazing degree. When they are arrived to their full growth, they who are intrusted by the lord of the island draw them from their holes; and, that they may more readily keep an account of the number they take, cut off one foot as a token. Their flesh is said to be excessively rank, as they feed upon fish, especially sprats, and sea-weed; however, when they are pickled and preserved with spices, they

cused of dispossessing the rabbits, the legitimate proprietors of the soil, and even of killing and devouring their young. But it would require more authentic testimony than we have yet met with to convince us of this alleged robbery; the only apparent evidence being, that they are found burrowing *along with rabbits* in similar holes. We very commonly find, in the same sand-bank, numerous perforations crowded into a small place, the work of various species of solitary bees, side by side and intermingled with those of sand-wasps; but no naturalist who has accurately observed the proceedings of these insects would conclude that they were mutual robbers, merely because he observed them going in and out of contiguous holes. In some instances, we are certain that the puffin must form its own burrows. * In one part of the island' (Akaroë), says Professor Hooker, 'where there is a considerable quantity of rich loose mould, the puffins breed in vast numbers, forming holes three or four feet below the surface, resembling rabbit-burrows, at the bottom of which they lay a single white egg, about the size of that of a lapwing, upon the bare earth. Our people dug out about twenty of these birds, which they afterwards assured me made an excellent sea-pie.' He elsewhere tells us that Iceland contains no indigenous quadrupeds, and he does not enumerate rabbits among those introduced. The climate indeed would probably be too cold for them. If the puffin, however, is really a robber of rabbit-burrows, it is too formidably armed to allow of retaliation with impunity, and few birds or beasts venture to attack it in its retreat. Sometimes, however, as Jacobson tells us, the raven makes bold to offer battle; but as soon as he approaches, the puffin catches him under the throat with her beak and sticks her claws into his breast till he screams out with pain and tries to get away; but the puffin keeps fast hold of him and tumbles him about till both frequently fall into the sea, where the raven is drowned and the puffin returns in triumph to her nest. But should the raven at the first onset get hold of the puffin's neck, he generally comes off victorious, kills the mother, and feasts on her eggs or her young."—Ed.

are admired by those who are fond of high eating. We are told, that formerly their flesh was allowed by the church on Lenten days. They were, at that time, also taken by ferrets, as we do rabbits. At present, they are either dug out, or drawn out, from their burrows, with a hooked stick. They bite extremely hard, and keep such fast hold of whatsoever they seize upon, as not to be easily disengaged. Their noise, when taken, is very disagreeable, being like the efforts of a dumb person attempting to speak.

The constant depredation which these birds annually suffer, does not in the least seem to intimidate them, or drive them away; on the contrary, as the people say, the nest must be robbed or the old ones will breed there no longer. All birds of this kind lay but one egg; yet if that be taken away, they will lay another, and so on to a third; which seems to imply, that robbing their nests does not much intimidate them from laying again.³ Those, however, whose nests have been thus destroyed, are often too late in bringing up their young; who, if they be not fledged and prepared for migration when all the rest depart, are left at land to shift for themselves. In August the whole tribe is seen to take leave of their summer residence; nor are they observed any more till the return of the ensuing spring. It is probable that they sail away to more southern regions, as our mariners frequently see myriads of water-fowl upon their return, and steering usually to the north. Indeed the coldest countries seem to be their most favoured retreats; and the number of water-fowl is much greater in those colder climates than in the warmer regions

³ Audubon, writing of the Black Guillemot, till recently supposed the proprietor of only a single egg, says: "What was most surprising to me was, that even the fishermen there thought that this bird laid only a single egg; and when I asked them how they knew, they simply and good-naturedly answered that they had heard so. Thus, reader, I might have been satisfied with the sayings of others, and repeated that the bird in question lays one egg; but, instead of taking this easy way of settling the matter, I found it necessary to convince myself of the fact by my own observation. I had therefore to receive many knocks and bruises in scrambling over rugged crags and desolate headlands; whereas, with less incredulity, I might very easily have announced to you from my easy chair in Edinburgh, that the black guillemots of America lay only a single egg. No true student of nature ought ever to be satisfied without personal observation when it can be obtained." "A closet naturalist," he adds, "was quite surprised, I have been told, when he read in one of my volumes that grakles form no nests in one portion of the United States, being there contented with merely dropping their eggs in the bottom of a woodpecker's hole; while in the Middle States the same species forms a very snug nest. That his astonishment was great I do not in the least doubt, especially as I know how surprised I was to find the *Larus argentatus* breeding on fir-trees forty feet above the ground, and to see three eggs, instead of one, placed on a bed of small pebbles beautifully arranged, and every one belonging to a single pair of black guillemots."—Ed.

near the line. The quantity of oil which abounds in their bodies, serves as a defence against cold, and preserves them in vigour against its severity; but the same provision of oil is rather detrimental in warm countries, as it turns rancid, and many of them die of disorders which arise from its putrefaction. In general, however, water-fowl can be properly said to be of no climate; the element upon which they live being their proper residence. They necessarily spend a few months of summer upon land, to bring up their young; but the rest of their time is probably consumed in their migrations, or near some unknown coasts, where their provision of fish is found in greatest abundance.

Before I go to the third general division of water-fowls, it may not be improper to observe, that there is one species of round-billed water-fowl that does not properly lie within any of the former distributions. This is the Gooseander;⁴ a bird with the body and wings shaped like those of the penguin kind, but with legs not hid in the belly. It may be distinguished from all others by its bill, which is round, hooked at the point, and toothed, both upper and under chap, like a saw. Its colours are various and beautiful; however, its manners and appetites entirely resemble those of the diver. It feeds upon fish, for which it dives; and is said to build its nest upon trees, like the heron and the cormorant. It seems to form the shade between the penguin and the goose kind; having a round bill like the one; and unembarrassed legs, like the other. In the shape of the head, neck, and body, it resembles them both.

⁴ This is the largest of the auk kind, weighing about 4 pounds.—Ed.

SUPPLEMENTARY NOTE.

The *Great Northern diver*, which is the principal of the auk tribe, is nearly three feet and a half in length. The bill is black, and is four inches and a half long. The head and neck are of a deep velvet black. Under the chin is a patch of white, marked with several parallel lines of black; and on each side of the neck, and on the breast, is also a large portion of white marked in a similar manner. The upper parts are black, marked with white spots; and the under parts are white; the wings are short; and the quills, tail, and legs, are black. The female is less than the male. It inhabits chiefly the northern seas, and is common on some of the coasts of Scotland. Every part and proportion of this bird is most admirably adapted to its mode of life. The head is sharp, and smaller than the part of the neck adjoining, in order that it may pierce the water; the wings are placed forward, and out of the centre of gravity, for a purpose which will be noticed hereafter; the thighs quite at the prodix, in order to facilitate diving; and the legs are flat, and as sharp backwards almost as the edge of a knife, that, in striking they may easily cut the water; while the feet are broad for swimming, yet so folded up, when advanced forward to take a fresh stroke, as to be full as narrow as the shank. The two exterior toes of the feet are longest; and the nails are flat and broad, resembling the human, which give strength, and increase the

power of swimming. The foot, when expanded, is not at right angles with the leg; but the exterior part inclining towards the head, forms an acute angle with the body, the intention being, not to give motion in the line of the legs themselves, but, by the combined impulse of both in an intermediate line, the line of the body.

Most people, who have exercised any degree of observation, know that the swimming of birds is nothing more than a walking in the water, where one foot succeeds the other, as on the land. "But no one, as far as I am aware," says the Rev. Mr. White, "has remarked, that diving fowls, while under water, impel and row themselves forward by a motion of their wings, as well as by the impulse of their feet; yet such is really the case, as any one may easily be convinced who will observe ducks when hunted by dogs in a clear pond. Nor do I know that any one has given a reason why the wings of diving fowls are placed so forward; doubtless not for the purpose of promoting their speed in flying, since that position certainly impedes it; but probably for the increase of their motion under water, by the use of four oars instead of two: and were the wings and feet nearer together, as in land birds, they would, when in action, rather hinder than assist one another."

The *Speckled diver* is not quite so large as the other.

The *Great auk* inhabits Europe and America; is three feet in length; is very timid; it has not the power of flying; its food is chiefly fishes. The bill is black, compressed, and edged; and has eight or ten grooves: there is an oval spot on each side before the eyes. The wings are so short as to appear as only rudiments; secondary quill feathers tipped with white; the legs are black. Its egg is six inches long, and white, with purplish lines and spots.

The *Little auk* also inhabits Europe and America, and measures nine inches in length. The bill is short, black, smooth, and conic; the back is black, with a few dusky lines; the secondary quill feathers are tipped with white. It has a white dot above the eyes; the tips of the hind quill feathers are white; the legs are black.

The *Guillemot* is about the size of a common duck. The upper parts of the body are of a dark brown colour, inclining to a black, except the tips of some of the wing feathers, which are white; all the under parts of the body are also white. The tail is about two inches long. These are simple birds, and easily taken. They generally join company with other birds, and breed on the inaccessible rocks and steep cliffs in the Isle of Man; and likewise in Cornwall; on Priestholm Island, near Beaumaris, in the isle of Anglesey; also on the Fern Island, near Northumberland; and the cliffs about Scarborough, in Yorkshire; and several other places in England. They lay exceeding large eggs, being full three inches long, blunt at the one end, sharp at the other, of a sort of bluish colour, spotted generally with some black spots or strokes.

The *Black Guillemot* is in length about fourteen inches, breadth twenty-two, and its weight fourteen ounces. In some of this species the whole plumage is black; in others the lesser quills are tipped with white; and all those that remain in the northern climates are said to turn white in winter. These birds are found in great numbers in the north sea, in Greenland, Iceland, Spitsbergen, and the Feroe isles; and when the winter sets in, they migrate southward along the shores of Scotland and England, where some of them remain and breed. The nest is made in the deep crevices of rocks which overhang the sea; the eggs are of a gray colour. Some ornithologists assert, that the female lays only one; others, that she lays two. They fly commonly in pairs, and so low that they raise the surface of the

sea by the flapping of their narrow wings. The Greenlanders eat the flesh of this bird, and use its skin for clothing, and the legs as a bait for their fishing-lines. Ray, Albin, Willoughby, and Edwards have named it the Greenland dove, or sea-turtle. In the Orkneys it is called the tyste.

The *Grebes*—already noticed by Goldsmith in his chapter on the water-hen and coot—belong to this family of birds. They are not web-footed, but the toes are enlarged as in the coots. They live on lakes and ponds, and build in the rushes. Their plumage, which changes much with age, is used frequently by furriers.

CHAP. IX.

OF BIRDS OF THE GOOSE KIND, PROPERLY SO CALLED.

THE Swan, the Goose, and the Duck, are leaders of a numerous, useful, and beautiful tribe of birds, that we have reclaimed from a state of nature, and have taught to live in dependence about us. To describe any of these, would be as superfluous as definitions usually are when given of things with which we are already well acquainted. There are few that have not had opportunities of seeing them, and whose ideas would not anticipate our description. But, though nothing be so easy as to distinguish these in general from each other, yet the largest of the duck kind approach the goose so nearly, that it may be proper to mark the distinctions.

The marks of the goose are, a bigger body, large wings, a longer neck, a white ring above the rump, a bill thicker at the base, slenderer towards the tip, with shorter legs placed more forward on the body. They both have a waddling walk; but the duck, from the position of its legs, has it in a greater degree. By these marks, these similar tribes may be known asunder; and though the duck should be found to equal the goose in size, which sometimes happens, yet there are still other sufficient distinctions.

But they all agree in many particulars; and have a nearer affinity to each other than the neighbouring kinds in any other department. Their having been tamed has produced alterations in each, by which they differ as much from the wild ones of their respective kinds, as they do among themselves. There is nearly as much difference between the wild and the tame duck, as between some sorts of the duck and the goose; but still the characteristics of the kind are strongly marked and obvious; and this tribe can never be mistaken.

The bill is the first great obvious distinction of the goose kind from all of the feathered tribe. In other birds, it is round and wedge-like, or crooked at the end. In all the goose-kind it is flat and broad, made for the purpose of skimming ponds and lakes of the mantling weeds that stand on the surface. The bills of other birds are made

of a horny substance throughout; these have their inoffensive bills sheathed with a skin which covers them all over. The bill of every other bird seems, in some measure, formed for piercing or tearing; theirs are only fitted for shovelling up their food, which is chiefly of the vegetable kind.

Though these birds do not reject animal food when offered them, yet they can contentedly subsist upon vegetables, and seldom seek any other. They are easily provided for; wherever there is water, there seems to be plenty. All the other web-footed tribes are continually voracious, continually preying. These lead more harmless lives: the weeds on the surface of the water, or the insects at the bottom, the grass by the bank, or the fruits and corn in cultivated grounds, are sufficient to satisfy their easy appetites; yet these, like every other animal, will not reject flesh, if properly prepared for them; it is sufficient praise to them that they do not eagerly pursue it.

As their food is chiefly vegetables, so their fecundity is in proportion. We have had frequent opportunities to observe, that all the predatory tribes, whether of birds or quadrupeds, are barren and unfruitful. We have seen the lion with its two cubs; the eagle with the same number; and the penguin with even but one. Nature that has supplied them with powers of destruction, has denied them fertility. But it is otherwise with these harmless animals I am describing. They seem formed to fill up the chasms in animated nature, caused by the voraciousness of others. They breed in great abundance, and lead their young to the pool the instant they are excluded.

As their food is simple, so their flesh is nourishing and wholesome. The swan was considered as a high delicacy among the ancients; the goose was abstained from as totally indigestible. Modern manners have inverted tastes; the goose is now become the favourite; and the swan is seldom brought to table, unless for the purposes of ostentation. But at all times the flesh of the duck was in high esteem; the ancients thought even more highly of it than we do. We are contented to eat it as a delicacy; they also considered it as a medicine; and Plutarch assures us, that Cato kept his whole family in health, by feeding them with duck whenever they threatened to be out of order.

These qualities, of great fecundity, easy sustenance, and wholesome nourishment, have been found so considerable as to induce man to take these birds from a state of nature, and render them domestic. How long they have been thus dependents upon his pleasures is not known; for, from the earliest accounts, they were considered as familiars about him. The time must have been very remote; for there have been many changes wrought in their colours, their figures, and even their internal parts, by human cultivation. The different kinds of these birds, in a

wild state, are simple in their colourings; when one has seen a wild goose or a wild duck, a description of its plumage will, to a feather, exactly correspond with that of any other. But in the tame kinds, no two of any species are exactly alike. Different in their size, their colours, and frequently in their general form, they seem the mere creatures of art; and having been so long dependent upon man for their support, they seem to assume forms entirely suited to his pleasures or necessities.

CHAP. X.

OF THE SWAN, TAME AND WILD.

No bird makes a more indifferent figure upon land, or a more beautiful one in the water, than the swan. When it ascends from its favourite element, its motions are awkward, and its neck is stretched forward with an air of stupidity; but when it is seen smoothly sailing along the water, commanding a thousand graceful attitudes, moving at pleasure without the smallest effort; "when it proudly rows in state," as Milton has it, "with arched neck, between its white wings mantling," there is not a more beautiful figure in all nature. In the exhibition of its form, there are no broken or harsh lines, no constrained or writhing motions; but the roundest contours, and the easiest transitions; the eye wanders over every part with insatiable pleasure, and every part takes a new grace with a new motion.

This fine bird has long been rendered domestic; and it is now a doubt whether there be any of the tame kind in a state of nature. The wild swan, though so strongly resembling this in colour and form, is yet a different bird; for it is very differently formed within. The wild swan is less than the tame by almost a fourth; for as the one weighs twenty pounds, the other only weighs sixteen pounds and three quarters. The colour of the tame swan is all over white; that of the wild bird is, along the back and the tips of the wings, of an ash colour. But these are slight differences compared to what are found upon dissection. In the tame swan, the windpipe sinks down into the lungs in the ordinary manner; but in the wild, after a strange and wonderful contortion, like what we have seen in the crane, it enters through a hole formed in the breast-bone; and being reflected therein, returns by the same aperture; and being contracted into a narrow compass by a broad and bony cartilage, it is divided into two branches, which, before they enter the lungs, are dilated, and, as it were, swollen out into two cavities.

Such is the extraordinary difference between these two animals, which externally seem to be of one species. Whether it is in the power of long-continued captivity and domestication to

produce this strange variety, between birds otherwise the same, I will not take upon me to determine. But certain it is, that our tame swan is nowhere to be found, at least in Europe, in a state of nature.

As it is not easy to account for this difference of conformation, so it is still more difficult to reconcile the accounts of the ancients with the experience of the moderns, concerning the vocal powers of this bird. The tame swan is one of the most silent of all birds; and the wild one has a note extremely loud and disagreeable. It is probable, the convolutions of the windpipe may contribute to increase the clangour of it; for such is the harshness of its voice, that the bird from thence has been called the hooper. In neither is there the smallest degree of melody; nor have they, for above this century, been said to give specimens of the smallest musical abilities; yet, notwithstanding this, it was the general opinion of antiquity, that the swan was the most melodious bird; and that even to its death, its voice went on improving. It would show no learning to produce what they have said upon the music of the swan: it has already been collected by Aldrovandus; and still more professedly by the Abbe Gedoyne, in the Transactions of the Academy of Belles Lettres. From these accounts, it appears that, while Plato, Aristotle, and Diodorus Siculus, believed the vocality of the swan, Pliny and Virgil seem to doubt that received opinion. In this equipose of authority Aldrovandus seems to have determined in favour of the Greek philosophers; and the form of the windpipe in the wild swan, so much resembling a musical instrument, inclined his belief still more strongly. In aid of this also, came the testimony of Pendasius, who affirmed, that he had often heard swans sweetly singing in the lake of Mantua, as he was rowed up and down in a boat; as also of Olaus Wormius, who professed that many of his friends and scholars had heard them singing. "There was," says he, "in my family, a very honest young man, John Rostorph, a student in divinity, and a Norwegian by nation. This man did, upon his credit, and with the interposition of an oath, solemnly affirm, that once in the territory of Dronten, as he was standing on the sea-shore, early in the morning, he heard an unusual and sweet murmur, composed of the most pleasant whistlings and sounds; he knew not at first whence they came, or how they were made, for he saw no man near to produce them; but looking round about him, and climbing to the top of a certain promontory, he there espied an infinite number of swans gathered together in a bay, and making the most delightful harmony; a sweeter in all his life-time he had never heard." These were accounts sufficient at least to keep opinion in suspense, though in contradiction to our own experience: but Aldrovandus, to put, as he supposed, the question past all doubt, gives us the testimony of a countryman of our own, from

whom he had the relation. This honest man's name was Mr. Geo. Braun, who assured him, that nothing was more common in England than to hear swans sing; that they were bred in great numbers in the sea near London; and that every fleet of ships that returned from their voyages from distant countries, were met by swans, that came joyfully out to welcome their return, and salute them with a loud and cheerful singing! It was in this manner that Aldrovandus, that great and good man, was frequently imposed upon by the designing and the needy: his unbounded curiosity drew round him people of every kind, and his generosity was as ready to reward falsehood as truth.—Poor Aldrovandus! after having spent a vast fortune for the purposes of enlightening mankind; after having collected more truth, and more falsehood, than any man ever did before him, he little thought of being reduced at last to want bread, to feel the ingratitude of his country, and to die a beggar in a public hospital!

Thus it appears that our modern authorities, in favour of the singing of swans, are rather suspicious, since they are reduced to this Mr. George Braun, and John Rostorph, the native of a country remarkable for ignorance and credulity. It is probable the ancients had some mythological meaning in ascribing melody to the swan; and as for the moderns, they scarcely deserve our regard. The swan, therefore, must be content with that share of fame which it possesses on the score of its beauty; since the melody of its voice, without better testimony, will scarcely be admitted by even the credulous.

This beautiful bird is as delicate in its appetites, as elegant in its form. Its chief food is corn, bread, herbs growing in the water, and roots and seeds, which are found near the margin. It prepares a nest in some retired part of the bank, and chiefly where there is an islet in the stream. This is composed of water-plants, long grass, and sticks; and the male and female assist in forming it with great assiduity. The swan lays seven or eight eggs, white, much larger than those of a goose, with a hard, and sometimes a tuberculous, shell. It sits near two months before its young are excluded; which are ash-coloured when they first leave the shell, and for some months after. It is not a little dangerous to approach the old ones when their little family are feeding round them. Their fears as well as their pride, seem to take the alarm; and they have sometimes been known to give a blow with their pinion, that has broke a man's leg or arm.

It is not till they are a twelvemonth old that the young swans change their colour with their plumage. All the stages of this bird's approach to maturity are slow, and seem to mark its longevity. It is two months hatching; a year in growing to its proper size: and if, according to Pliny's observation, those animals that are longest in the womb are the longest lived, the swan is

the longest in the shell of any bird we know, and is said to be remarkable for its longevity. Some say that it lives three hundred years; and Wilmoughby, who is in general diffident enough, seems to believe the report. A goose, as he justly observes, has been known to live a hundred; and the swan, from its superior size, and from its harder, firmer flesh, may naturally be supposed to live still longer.

Swans were formerly held in such great esteem in England, that by an act of Edward the Fourth, none, except the son of the king, was permitted to keep a swan, unless possessed of five marks a-year. By a subsequent act, the punishment for taking their eggs was imprisonment for a year and a day, and a fine at the king's will. At present, they are but little valued for the delicacy of their flesh; but many are still preserved for their beauty. We see multitudes in the Thames and Trent; but nowhere greater numbers than on the salt-water inlet of the sea, near Abbotsbury, in Dorsetshire.

SUPPLEMENTARY NOTE.

Of the characters by which the swans are distinguished from the rest of the family, the most remarkable are the extreme length of their necks; the oval shape of their nostrils, which are placed about the middle of their bill; the nakedness of their cheeks; the equal breadth of their bills throughout; the great depth of that organ at the base, where the vertical considerably exceeds the transverse diameter; and the position of their legs behind the centre of gravity. They are by far the largest species of the family; and there are very few birds that exceed them in magnitude. They live almost constantly upon the water, preferring the larger streams and open lakes; and feed chiefly upon aquatic plants, the roots of which they are enabled to reach by means of their long necks, for they rarely if ever plunge the whole of their bodies beneath the surface. They also devour frogs and insects, and occasionally, it is said, even fishes; but this last assertion is contradicted by almost every observer who has attended particularly to their habits, and seems quite at variance with the fact that the fish-ponds to which they are sometimes confined do not appear to suffer the smallest diminution in the number of their inhabitants from the presence of these inoffensive birds. In their habits they are as peaceable as they are majestic in form, elegant in attitude, graceful in their motions, and, in the two species that are most commonly known to us, unsullied in the purity of their white and glossy plumage.

Of these species that which is known, improperly with reference to a large proportion of the individuals that compose it, as the tame swan, is probably the most common, being found in a state of domestication throughout the greater part of the northern hemisphere. In a wild state it is met with in almost every country of Europe, especially towards the east, and is particularly abundant in Siberia. Its distinguishing characters are found chiefly in its bill, which is throughout of an orange red, with the exception of the edges of the mandibles, the slight hook at the extremity, the nostrils, and the naked spaces extending from the base towards the eyes, all of which are black. A large protuberance, also of a deep black, surmounts the base of the bill; the iris is brown; and the legs black, with a tinge of red. All the plumage, without exception, in the adult bird, is of the purest white. In length the full-grown male measures upwards of

five feet, and more than eight in the expanse of its wings, which reach, when closed, along two-thirds of the tail. Its weight is usually about twenty pounds, but it sometimes attains five and twenty or even thirty; and those which inhabit the southern coast of the Caspian are said to reach a still more enormous size. The female is rather smaller than the male; her bill is surmounted by a smaller protuberance; and her neck is somewhat more slender. When first hatched the young are of a dusky gray, with lead-coloured bill and legs; in the second year their plumage becomes lighter, and their bill and legs assume a yellowish tinge; in the third year they put on the adult plumage and colouring of the naked parts.

The wild birds of this species, like most of the water-fowl, are migratory in their habits. In the temperate regions of Europe they begin to absent themselves in October, and return towards the end of March to the quarters which they occupied in the preceding year. But when the winter is not particularly severe, they frequently remain through it, seeking for shelter among the dams and sluices of the rivers, and returning to their former quarters at the breaking of the frost. The females choose for their nestling-place the least frequented situations on the banks of the rivers or lakes which they inhabit, and build their nest in the rudest manner of twigs and reeds, lined with a comfortable coating of their breast feathers. They lay six or eight grayish eggs, and sit for five weeks, generally in April and May.

Although naturally one of the most gentle and inoffensive of birds, the large size and great muscular power of the swan render it a formidable enemy when driven to extremity, and compelled to act on the defensive. In such a case it is said to give battle to the eagle, and frequently even to repel his attack, forcing him to seek his safety in flight. It never attempts to molest any of the smaller water-fowl that inhabit its domains; but in the season of its amours it will not suffer a rival to approach its retreat without a sanguinary struggle, in which one or other is generally destroyed. It is said to attain a very great age, thirty years being commonly spoken of as the term of its existence. It is even asserted that in Alkmar, a town in the north of Holland, there died, in the year 1672, a swan belonging to the municipality, which bore on its collar the date 1573, and must consequently have been a century old; and several other instances of a similar nature have been related by authors. We must confess, however, that we entertain strong doubts of the authenticity of such statements, founded merely on popular tradition and unsupported by any positive evidence.

The *Wild swan*, or as it is not unfrequently termed, the *Hooper*, is a native of nearly the whole northern hemisphere. In the Old world it passes northwards as far as Iceland and Kamtschatka, skirting the borders of the Arctic circle, but rarely entering within its limits. Those which inhabit Europe generally pass the winter in its more southern regions, and even extend their flight to Egypt and Barbary; while the Asiatic birds seem rarely to pass much farther south than the shores of the Caspian and Black seas. In America the range of their migrations is bounded by Hudson's bay on the north, and Louisiana and the Carolinas on the south. They are extremely abundant in the northern parts of the New continent and in Siberia; and in many districts of Russia they take the place of that which is improperly termed the tame species, submitting themselves with equal readiness to the process of domestication.

The external differences between these two swans are not at first sight very obvious; but, trivial as they appear, they are uniform and constant. The bill of the present species is entirely destitute of protuberance at its base, and its colours are in a great degree reversed, the black occupying the point and

nearly the whole of the bill, its base alone and the spaces extending from it beneath the eyes being of a bright yellow. The legs are black or dusky; the iris brown; and the entire plumage, as in the other species, pure white, but with an occasional tinge of yellowish gray. The young pass through similar gradations of colour with those of the tame swan, and arrive, like them, at their perfect plumage about the third or fourth year.

Slight as are these outward differences, they are fully sufficient for the detection of the species; and the separation founded upon them receives ample confirmation from anatomical characters of the highest importance. Not to speak of the difference in the number of their ribs, which are twelve in the wild Swan, and eleven only in the tame, their tracheæ or windpipes afford unquestionable evidence of their distinctness. Ray was the first to point out this marked distinction between the two birds, which had previously been regarded as doubtful species. It was neglected, however, by later naturalists, and even Buffon and Linnæus were inclined to consider them as mere varieties; but in these days, when the importance of anatomical characters is fully recognised, they are universally allowed to be distinct.

A third species, lately described by Mr. Yarrell, is equally distinct from the hooper and the tame swan, although inhabiting the same localities as the former, and apparently by no means of unfrequent occurrence. This bird, which had been entirely overlooked by all systematic ornithologists, is about one-third less than the common wild swan; but its trachea, of smaller comparative calibre, passes still more deeply into the cavity of the sternum, at the extremity of which, quitting the keel, it takes a horizontal direction, and occupies the posterior flattened portion of the bone. The bronchi or subdivisions of the windpipe are less than half the length of the same parts in the common hooper. Outwardly the differences between the two birds are even less strongly marked than those which distinguish the wild and tame swans from each other; consisting principally in the deep orange colour of the base of the bill, which is confined to a more limited space than the yellow on the same part in the hooper, and does not advance upon the sides; and in the number of the quill-feathers of the tail, which are eighteen in the new species and twenty in the old. To this fine addition to our list of native birds Mr. Yarrell has applied the name of Bewick's swan, in commemoration of an artist whose labours have done so much to render the study of ornithology popular in this country.

In habits the Wild swan bears a close resemblance to the tame. It flies with so much rapidity, especially when sailing before the wind, that the difficulty of shooting it is extremely great. Hearne asserts that it is "frequently necessary to take a sight ten or twelve feet before their bills;" and adds that "in a brisk gale, they cannot fly at a less rate than a hundred miles an hour, but when flying across the wind or against it, they make but a slow progress, and are then a noble shot." They are much sought after in those countries where they are abundant, for their flesh, their quill-feathers, and their down. The former, according to the author just quoted, "is excellent eating, and, when roasted, is equal in flavour to young heifer beef, and the cygnets are very delicate." It is possible that in this instance the keen appetite of the sportsman may have imparted a relish to his game which it did not intrinsically possess. In Europe it is little sought after, and although cygnets are occasionally served upon the tables of the great, the rarity of the dish may be supposed to add not a little to its actual flavour, which to the taste of beef joins somewhat of that which is common to ducks and most of our water-fowl.

The Wild swans arrive in Hudson's Bay as early as March, preceding all the other species of water-fowl. While the rivers remain frozen, they frequent the falls and rapids, where they are often shot by the Indians in large numbers. They are also pursued by the natives in the moulting time, which takes place in July and August; but it is extremely difficult to catch them, as they run with great swiftness on the surface of the water. In Iceland and Kamtschatka they are hunted at this time with dogs and horses, and frequently distance the latter, but are eventually pulled down by the dogs, which seize them by the neck and overbalance them. The female usually builds her nest on an island in the centre of a lake, and lays from five to seven eggs, "so big," says Hearne, "that one of them is sufficient for a moderate man, without bread or any other addition." They are of a dirty white with a shade of olive green. As in the Tame species, the battles between the males are frequent and obstinately contested, sometimes lasting for a whole day, and not uncommonly terminating in the death of one or other of the combatants.

The Black swan.—When the classical writers of antiquity spoke of the Black swan as a proverbial rarity, so improbable as almost to be deemed impossible, little did they imagine that in these latter days a region would be discovered, nearly equal in extent to the Roman empire even at the proudest period of its greatness, in which their "rara avis" would be found in as great abundance as the common Wild Swan upon the lakes of Europe. Such, however, has been one of the least singular among the many strange and unexpected results of the discovery of the great southern continent of New Holland. Scarcely a traveller who has visited its shores omits to mention this remarkable bird. An early notice of its transmission to Europe occurs in a letter from Witsen to Dr. Martin Lister, printed in the twentieth volume of the *Philosophical Transactions*; and Valentyn published in 1726 an account of two living specimens brought to Batavia.

Since this period many living individuals have been brought to England, where they thrive equally well with the Emeus, the Kangaroos, and other Australian animals, inasmuch that they can now scarcely be regarded as rarities even in this country. They are precisely similar in form, and somewhat inferior in size to the wild and tame swans of the Old world; but are perfectly black in every part of their plumage, with the exception of the primary and a few of the secondary quill-feathers, which are white. Their bill is of a bright red above, and is surmounted at the base in the male by a slight protuberance, which is wanting in the female. Towards its anterior part it is crossed by a whitish band. The under part of the bill is of a grayish white; and the legs and feet are of a dull ash colour. In every other respect, except in the mode of convolution of its trachea, this bird so perfectly corresponds with its well known congeners, that it is only necessary to refer to the articles in which we shall hereafter describe those beautiful species for an account of the characters which are common to them all. The black swans are found as well in Van Diemen's Land as in New South Wales and on the western coast of New Holland. They are generally seen in flocks of eight or nine together, floating on a lake; and when disturbed, flying off like wild geese in a direct line one after the other. They are said to be extremely shy, so as to render it difficult to approach within gunshot of them.

CHAP. XI.

OF THE GOOSE, AND ITS VARIETIES.

THE Goose, in its domestic state, exhibits a variety of colours. The wild goose always retains the same marks; the whole upper part is ash-coloured; the breast and belly are of a dirty white; the bill is narrow at the base, and at the tip it is black; the legs are of a saffron colour, and the claws black. These marks are seldom found in the tame; whose bill is entirely red, and whose legs are entirely brown. The wild goose is rather less than the tame; but both invariably retain a white ring round their tail, which shows that they are both descended from the same original.

The wild goose is supposed to breed in the northern parts of Europe; and, in the beginning of winter, to descend into more temperate regions. They are often seen flying at very great heights, in flocks from fifty to a hundred, and seldom resting by day. Their cry is frequently heard when they are at an imperceptible distance above us; and this seems banded from one to the other, as among hounds in the pursuit. Whether this be the note of mutual encouragement, or the necessary consequence of respiration, is doubtful; but they seldom exert it when they alight in these journeys.

Upon their coming to the ground by day, they range themselves in a line, like cranes; and seem rather to have descended for rest than for other refreshment. When they have sat in this manner for an hour or two, I have heard one of them, with a loud long note, sound a kind of charge, to which the rest punctually attended, and they pursued their journey with renewed alacrity. Their flight is very regularly arranged; they either go in a line abreast, or in two lines, joining in an angle in the middle. I doubt whether the form of their flight be thus arranged to cut the air with greater ease, as is commonly believed; I am more apt to think it is to present a smaller mark to fowlers from below. A bullet might easily reach them if huddled together in a flock, and the same discharge might destroy several at once; but, by their manner of flying, no shot from below can affect above one of them; and from the height at which they fly this is not easy to be hit.

The Barnacle differs, in some respects, from both these; being less than either, with a black bill, much shorter than either of the preceding. It is scarcely necessary to combat the idle error of this bird's being bred from a shell sticking to ships' bottoms; it is well known to be hatched from an egg in the ordinary manner, and to differ in very few particulars from all the rest of its kind.

The Brent Goose is still less than the former, and not bigger than a Muscovy duck, except

that the body is longer. The head, neck, and upper part of the breast, are black; but about the middle of the neck, on each side, are two small spots or lines of white, which together appear like a ring.

These, and many other varieties, are found in this kind, which agree in one common character of feeding upon vegetables, and being remarkable for their fecundity. Of these, however, the tame goose is the most fruitful. Having less to fear from its enemies, leading a securer and a more plentiful life, its prolific powers increase in proportion to its ease; and though the wild goose seldom lays above eight eggs, the tame goose is often seen to lay above twenty. The female hatches her eggs with great assiduity; while the gander visits her twice or thrice a-day, and sometimes drives her off to take her place, where he sits with great state and composure.

But beyond that of all animals is his pride when the young are excluded: he seems then to consider himself as a champion, not only obliged to defend his young, but also to keep off the suspicion of danger; he pursues dogs and men that never attempt to molest him: and, though the most harmless thing alive, is then the most petulant and provoking. When, in this manner, he has pursued the calf or the mastiff, to whose contempt alone he is indebted for safety, he returns to his female and her brood in triumph, clapping his wings, screaming, and showing all the marks of conscious superiority. It is probable, however, these arts succeed in raising his importance among the tribe where they are displayed; and it is probable there is not a more respectable animal on earth to a goose than a gander!

A young goose is generally reckoned very good eating; yet the feathers of this bird still farther increase its value. I feel my obligations to this animal every word I write; for, however deficient a man's head may be, his pen is nimble enough upon every occasion: it is happy indeed for us that it requires no great effort to put it in motion. But the feathers of this bird are still as valuable in another capacity, as they make the softest and the warmest beds to sleep on.

Of goose-feathers most of our beds in Europe are composed; in the countries bordering on the Levant, and in all Asia, the use of them is utterly unknown. They there use mattresses, stuffed with wool, or camels' hair, or cotton; and the warmth of their climate may perhaps make them dispense with cushions of a softer kind. But how it happens that the ancients had not the use of feather-beds is to me surprising: Pliny tells us, indeed, that they made bolsters of feathers to lay their heads on; and this serves as a proof that they turned feathers to no other uses.

As feathers are a very valuable commodity, great numbers of geese are kept tame in the fens of Lincolnshire, which are plucked once or twice a-year. These make a considerable article of

commerce. The feathers of Somersetshire are most in esteem; those of Ireland are reckoned the worst. Hudson's Bay also furnishes very fine feathers, supposed to be of the goose kind. The down of the swan is brought from Dantzic. The same place also sends us great quantities of the feathers of the cock and hen; but Greenland, Iceland, and Norway, furnish the best feathers of all: and in this number we may reckon the eider down, of which we shall take notice in its place. The best method of curing feathers is to lay them in a room, in an open exposure to the sun; and when dried, to put them into bags, and beat them well with poles to get the dust off. But, after all, nothing will prevent, for a time, the heavy smell which arises from the putrefaction of the oil contained in every feather; no exposure will draw this off, how long so ever it be continued; they must be lain upon, which is the only remedy; and for this reason old feathers are much more valuable than new.

SUPPLEMENTARY NOTE.

The flight of wild geese takes place without noise, and the order in which it is performed presupposes no small degree of combination and intelligence. It is an arrangement the most favourable for each individual to follow in its place and preserve its proper rank, and for the entire flock to cut the air with the smallest degree of fatigue. They place themselves in two oblique lines, forming an angle, or in a single line when the troop is not very numerous. He who is at the head of the angle cuts the air first, retires to the last rank to repose himself when fatigued, and the others take his place in their turns. There are certain points, so to speak, from which the grand armies of these birds divide, to spread themselves through different countries; such are Mount Taurus relatively to Asia Minor, and Mount Stella, where they repair in the after-season, and from whence they disperse through Europe. These secondary bands unite again, and form others, which, to the number of four or five hundred, come sometimes in winter, and alight upon our fields, where they feed upon the corn and grass, scraping away the snow. Every evening after sunset, the wild geese repair to ponds and rivers, where they pass the night, that they may enjoy security. Their habits, in this respect, are very different from those of ducks, which go, during the night, to pasture in the fields, and do not return to the water but when the geese quit it. It is only during not very severe winters that the wild geese remain any time in temperate climates; for when the rivers are frozen, they advance more southward, whence they retire towards the end of March, to return to the north, and proceed into the most elevated latitudes, to Spitzbergen, Greenland, to the shores of the Frozen ocean, and to Hudson's Bay,—where their fat and dung constitute a resource for the hardy inhabitants.

The geese have good sight, very fine hearing, and their vigilance is so great that they are never taken at fault. While they are eating, or sleeping, there is always a sentinel in the troop, who, with his neck stretched out, and head in the air, is ready to give the signal of danger. If we add to these signs of intelligence, and to the remarks already made on the arrangement of their order of flight, the signal proofs of attachment, which domestic geese have exhibited on many occasions, we shall perceive how little foundation there is for the popular opinion respect-

ing their stupidity. This indeed appears to have been formed merely on external characters; on their walk, their stretched out neck, gaping mouth, and the sound of their voice, especially when they experience any terror. As these birds fly remarkably high, and do not alight but when they are over waters, there is considerable difficulty in shooting them; and their extreme distrust renders for the most part all the stratagems employed by fowlers of no avail. Our common application of the proverb, "a wild-geese chase," sufficiently proves this, and ought to do away with the vulgar prejudice respecting their stupidity.

The goose has for many ages been celebrated on account of its vigilance. The story of their saving Rome by the alarm they gave, when the Gauls were attempting the capitol, is well known, and was probably the first time of their watchfulness being recorded; and on that account they were afterwards held in the highest estimation by the Roman people. It is certain that nothing can stir in the night, nor the least or most distant noise be made, without the geese being roused, and immediately beginning to hold a cackling converse; and on the nearer approach of apprehended danger, they set up their more shrill and clamorous cries. It is on account of this property that they are esteemed by many persons as the most vigilant of all sentinels, when placed in particular situations.

An old goose that had been for a fortnight hatching in a farmer's kitchen, was perceived on a sudden to be taken violently ill. She soon after left the nest, and repaired to an out-house where there was a young goose of the first year, which she brought with her into the kitchen. The young one immediately scrambled into the old one's nest, sat, hatched, and afterwards brought up the brood. The old goose, as soon as the young one had taken her place, sat down by the side of the nest, and shortly after died. As the young goose had never been in the habit of entering the kitchen before, "I know of no way of accounting for this fact," says Mr. Brew of Ennis, the narrator, "than by supposing that the old one had some way of communicating her thoughts and anxieties, which the other was perfectly able to understand. A sister of mine who witnessed the transaction gave me the information in the evening of the very day it happened." We are informed, in Loudon's 'Magazine of Natural History,' that in the year 1828, thirty domestic geese deserted the pond of a lady in Aberdeenshire, without any cause being known for this uncommon occurrence. A gentleman happened to see them in their flight seaward; and they were never afterwards heard of.

"Who of our good townsmen," says Mr. Motherwell, when editor of the 'Paisley Advertiser,' "has not seen, or at least heard of, the loyal goose of Paisley—the chivalrous and warlike goose of the years 1819 and 1820? In these years during the radical turmoils in this neighbourhood, this strange and venerable bird attracted universal attention by its devoted affection to the soldiery, and its aptitude and vigilance in walking sentry before the jail. Of its previous history we know little, save that he had been an inmate of the Saracen's Head inn for upwards of twenty years before; and had, till the year 1819, comported itself like a grave and well ordered member of its own species. In a heavy spout (flood), one winter twenty years ago, it had come floating down the Cart foundering in the rush of waters, and cackling lustily in the storm. Whence it came, or where and when born, remains matter of mystery and conjecture to this day. (1st Sept., 1827.) Certain it is, the adventurous voyager was stranded at the foot of the Dyers Wynd, and being there seized by some of the minor authorities of the town, as a waif or a wreck, was forthwith lodged in the town's

him, as a victim to be immolated at the next Christmas, or first civic feast. But age secured it from the vulgar indignity of being eaten. The cook declared it was too old by half-a-century, and that nothing but an ostrich-stomach could digest its iron frame; and after her judgment had been confirmed by other authorities skilled in gastronomic science, it was dismissed, and allowed the full and uncontrolled walk of the stable-yard. Here it vegetated till 1819, being handed over by each successive host of the Saracen's Head, to the next tenant, as a part and portion of the premises. In the eventful years 1819 and 1820, it gave its first indications of attachment to a military life. The sight of a red coat and musket were attractions it could not resist, and the roll of the drum or bugle call was sure to find a willing listener in this plumaged hero. Every day, for many months in these years, it was seen parading, slowly and stately, with measured waddle before the jail, following closely the heels of the sentinel, stopping when he stopped, and pacing when he paced. Night and day this loyal bird was found at its post. When it slept none could tell—its vigils were unremitting—and often have we seen the soldier share his brown loaf with this brother in arms. Thus did it continue in the faithful and constant discharge of its military duties so long as a red coat and musket gleamed before the jail. From these singular habits it became as well known to our townsmen as their cross steeple,—and often formed the topic of their conversation. It was revered as if it had been one of the sacred brood which preserved the capitol. When sentinels were discontinued, the goose still paced over its old haunt, in sullen majesty, dreaming of other and more turbulent days, and glorying in the recollection of how itself had stood, in the front of danger, unappalled and firm in its unshaken loyalty to the Crown and constitution. At length it forsook this station, finding its services there no longer useful, and speedily associated itself to the sergeant or corporal of each succeeding recruiting party that came to town. At the heels of some sergeant, who, morning and evening, wore out his shoes on the flags for lack of other employment, the goose was found acting as orderly, keeping behind him at the distance, as nearly as one could guess, of 'three paces and a stride.' When one sergeant left the town, the goose soon ingratiated itself with his successors: and when knots of these gentlemen assembled on the street, the goose was ever found in dignified silence, listening to their councils of war, and stories of battles won in distant lands. Besides this, it paid stated visits to sundry individuals whom it had favoured with its friendship. It could not chat; but it bade them good morning with a most affectionate gabble. When soldiers had to be billeted, by a species of precedence almost unaccountable it waddled to the door of the chamberlain's office, and there walked to and fro till the billets were distributed. To horse and foot—to regular and volunteer corps—it was alike kind and attentive. Whoever wore graciously his majesty's uniform was sure to be recognised by this singular bird. Many a time have we seen a military officer, if he chanced to walk near the cross, start, when he found the goose dogging him as diligently as if it were his shadow. To men in authority he showed a becoming deference, and even condescended occasionally to pick up a slight acquaintance with the subordinate officers of justice, choosing, however, those most remarkable for their size as especial favourites. For the last year, it was evident to the eyes of all that our eccentric was fast sinking under age and its accompanying infirmities. It had become almost blind, and very lame. Its drumsticks were overgrown with knotty excrescences, and many of its toes had been broken off by its previous campaigning, while the lustre of its once

snowy plumage was irretrievably gone. Yet to the last it continued to *hirple* over its wonted haunts, and to visit its early friends. When age-worn nature refused longer to obey the impulses of its heroic spirit, it shook off the burden of a life no more of use, in the fulness of its age, with a feeble sibilant, and a slight flutter of its wings, on Tuesday morning last (the 28th August, 1827), in the stable yard of the Saracen's Head inn. Many who, like the writer, have under the weight of a musket, been amused by observing the habits of this bird, and found it his sole companion in the dreary watch at night, will regret its death, and sympathize in the feeling, under which this slight piece of animal biography has been penned. The death of this feathered Nestor, it is not abusing the term to say, has created a general sensation in the town, nay, even general regret. Its age has been variously computed, but most are of opinion, that at the time of its death it must have been within a few years of a hundred."

"The following story, the truth of which we can vouch for," says the editor of the 'Dumfries Courier,' "is not only curious in itself, but evinces pretty forcibly, that whimsicality and eccentricity are not confined to the human species. Mr. Whigham, of Allanton, has a very large gander, which was hatched five or six years ago, which had scarcely attained the months of majority, when he contracted a dislike to his own species. Whether this arose from disappointed love, or a disposition naturally *gooseanthropical*, might puzzle the deepest naturalist to determine; but certain it is, that he feels so little pleasure in the society who have feathers on their backs, that the race would speedily become extinct were all ganders as ungallant as himself. In 1823, there were two pretty bay colts grazing in a field adjoining to Allanton, and to these he in time attached himself so cordially, that he became their companion night and day. From this, or some other circumstance, he retains a strong partiality to bays and browns, and will not associate with a black horse. The colts alluded to were succeeded by others; and the gander, though he seemed sensible of, and sorry for the change, speedily ingratiated himself with his new friends. These he attends in the paddock during the day, follows them home at night when the weather is cold, and if accidentally shut out of the stable, patiently bivouacs behind the door, and is always ready to clap his wings and go afield early in the morning. When in the park, his sole occupation seems to be to stand near the head of one of the colts, carefully watching all its motions, and accommodating his position to that of his friend, by waddling when he walks, and flying when he runs. Young horses, when disturbed, very easily break into a gallop, and as the gander manages to keep so near the colt, that he may be seen flying vigorously alongside of him, it is certainly strange that it never occurred to him to take a ride. If the mouth of the other, while collecting provender, should come too near his feet, he stretches forth his neck, elevates his wings, hisses gently, and, by other motions, admonishes the intruder to keep at a proper distance. Though geese graze as well as kine, the bird in question is rarely seen nibbling a pile of grass, and his chief dependence, we believe, is placed on the stray pickles of corn he caters in the stable. On one occasion, the young horses at Allanton were removed to a field at some distance, and then the poor gander had to *dree* a very dreary period of widowhood. If he could have spoken or sung, his ditty would have been, 'I wander dowie a' my lane;' but when the colts returned, that is the bay ones, he was seen hurrying to meet them, half-running, half-flying, and cackling forth his congratulations, to the very topmost note of the gamut of joy. In April last, 1827, we happened to be at Allanton, and, as a

matter of course, visited the biped of whose eccentric habits we had heard so much. A new scene then presented itself. In the course of the day, a score or two of capital Highland bullocks had been let into the field, and these the gander seemed to look on with a very jaundiced eye. By mere accident, one of them approached too near the favourite colt, an intrusion which was resented by a fierce and rather laughable onset. The bill of the bird was darted at the hard head of the enemy, and the latter, though furnished with a notable pair of horns, started back as quickly as if an adder had stung him. Again, however, he advanced to the charge, was again assaulted, and again retreated; until his brethren, perceiving what was going forward, joined in the *melée* and very nearly hemmed the gander in. Our first impression was, that the biped would be tossed and gored till not a pinion stuck together, but in this we were mistaken. Each of the bullocks was assailed in turn, to its no small amazement, if not dismay, but the assailant, *maugre* his great courage, appeared to be placed in a sad quandary, and did all he could to rescue the colt from such unsuitable company, by biting his heels, and nibbling at his head. The docile animal, at length, good-naturedly yielded to his wishes, and the horned belligerents on their part, ratified the armistice, by offering no farther molestation."

A correspondent of the 'London Times' of 16th April, 1835, writes: "The bustle of that bustling place, Leadenhall-market, has been considerably increased lately in consequence of the lying-in-state of an old inhabitant of that spot lately deceased, who was known amongst the poulterers and purveyors there by the cognomen of 'Old Tom.' For the last 12 years he has been seen running about, winter and summer, without shoes or stockings, and wearing the same coat. He was a native of France, lived a useful life, and was much respected by all his acquaintances. But to avoid mistake, though a biped, gentle reader, the deceased was only a goose. By his odd tricks and sagacity he secured to himself a host of friends, and did much to rescue his order from the stigma of stupidity which has been almost universally thrown upon it. This singular bird was hatched at Ostend in June 1797, and became the property of M. Bontanée, a dealer in poultry of that port, who employed him in the capacity of a decoy goose. Upon the death of this his first master, he was purchased at a large price by another dealer, named Blaney, in whose service he remained until the year 1823, performing the duties of his office with great success, and frequently travelling at the head of a numerous and obsequious flock upwards of ten miles a-day, leading them to the place of embarkation. While at Ostend he lived a merry life, was taught a hundred diverting tricks, and at the annual fair was always seen among the fantastic group with a mask and other grotesque appendages, exciting considerable amusement and receiving general applause. By some accident, poor Tom was sent to Mr. Grover, of Leadenhall-market, with a retinue he had escorted to Calais. As soon as his departure was discovered, letters were sent to request that he might be saved from the fate which awaited his companions, and returned to his master. But it seems that he was not destined to revisit his native country, for though he was easily selected from the rest by calling 'Tom' and offering a piece of bread, as often as he was sent to the Custom-house in a return-basket, some accident or oversight caused his further detention. He had many narrow escapes for his life, and in 1829 was sent to Mr. Levy's shop in Houndsditch with 11 others, 9 of which were already slaughtered, when Mr. Grover's son arrived just in time to save his neck from being wrung. At length his legitimate master arrived in London, and was recognised by

his old servant as soon as he saw him. Having, however, declined business, M. Blaney, after pointing out Tom's acquirements, requested Mr. Grover to keep him, and he would cheerfully pay all his expenses. Tom, the gander, then became the patriarch and guardian of all the geese and goslings that came to the market, and he was never known to let one go astray. He was a favourite with all, and the pet of many. He was a frequent visitor at the neighbouring gin-palaces, and would take several drams of the 'cream of the valley' in the course of the day—not, indeed, without being the worse for it sometimes; and then he would be, as the police term it, both 'drunk and disorderly.' Such was the effect which bad company had upon him; but it should be remembered that Tom was only a goose, and could not help himself. He distinguished his kindest friends by a mode of expression peculiar to himself, and clapping his wings. At a particular hour every day Tom might be seen walking with great dignity into the sign of the Rose and Crown, the hostess of which had some delicious morsels always prepared for him. One morning poor Tom was missed from his accustomed route, and on search being made, was found dead in his nest, having lived upwards of 37 years. Some of his survivors immediately set about paying their last tokens of respect to their deceased acquaintance. A process similar to that of embalming was gone through, and the body, placed in a deal box three feet long, was deposited in one of his master's stalls, where he lay in state, surrounded with funeral furniture, two of his favourite geese being posted at the door dressed in crape. A penny was demanded of those whose curiosity led them to take a last look, and the money thus collected was appropriated to the purchase of a stone tablet, and the other expenses of his interment. On the lid of his coffin is an engraved plate, with his name and age. Poor Tom is this day to be buried in a grave dug in the centre of the poultry-market, over which the stone will be laid, and the passenger may read thereon the following inscription and epitaph:—

"The grave of Poor Old Tom.
In memory of Old Tom the Gander.
Obit 19th March, 1835, *et*at. 37 years, 9 months, and 6 days.
This famous gander, while in stables,
Fed freely, without care or trouble;
Grew fat with corn and sitting still,
And scarce could cross the barn-door sill:
And seldom waddled forth to cool
His belly in the neighbouring pool.
Transplanted to another scene,
He stalk'd in state o'er Calais-green,
With full five hundred geese behind,
To his superior care consign'd,
Whom readily he would engage
To lead in march ten miles a-stage.
Thus a decoy he lived and died,
The chief of geese, the poulterer's pride."

The Snow Goose.—This bird is about the size of the common goose. The upper mandible of the bill is scarlet, and the lower one whitish. The general colour of the plumage is white, except the first ten quills of the wings, which are black, with white shafts. The young are of a blue colour, till they are a year old. The legs are red. These birds are very numerous about Hudson's bay, where they are migratory, going further northward to breed. They are also found in the northern parts of the old continent. The snow geese have so little of the shyness of the other species, that they are taken in a ludicrous manner, about Yakut, and the other parts of Siberia which they frequent. The inhabitants place near the banks of the rivers a great net in a straight line, or else form a hovel of skins sewed together; this done, one of the company dresses himself in the skin of a rein-deer, advances towards the flock of geese, and then turns back towards the net or hovel; and his companions go behind the rock, and, by making

a noise, drive them forward. The simple birds mistake the man in white for their leader, and follow him within reach of the net, which is suddenly pulled down on them, and thus captures the whole. When he chooses to conduct them to the hovel, they follow in the same manner; he creeps in at the hole left for that purpose and out at another at the opposite side, which he closes up. The geese follow him through the first; and as soon as they are in, he passes round and secures every one of them.

The Swan goose.—This species is more than a yard in length, and is of a size between the swan and the common goose. It is distinguished from others of the goose tribe by its upright and stately deportment, by having a large knob on the root of the upper mandible, and a skin almost bare of feathers, hanging down like a pouch, or a wattle under the throat; a white line or fillet is extended from the corner of the mouth over the front of the brow; the base of the bill is orange; irides reddish brown; a dark brown or black stripe runs down the hinder part of the neck, from the head to the back; the forepart of the neck and breast are yellowish-brown; the back and all the upper parts brownish-gray, edged with a lighter colour; the sides and feathers which cover the thighs are clouded nearly of the same colours as the back, and edged with white; belly white; and legs orange. It is said these birds originally were found in Guinea only: now they are become pretty common, in a wild as well as a domesticated state, both in warm and in cold climates. They breed with the common goose, and their offspring are as prolific as those of any other kind. The female is smaller than the male.

The Canadian goose.—The Canadian goose is somewhat larger than our common domesticated breed. It is also slenderer in its make and especially in its neck, which consequently approaches more nearly to that of the swan. The entire length of the bird is about three feet, and the expanse of its wings rather more than five. The back and wing-coverts are of a dull brown, with a whitish tip to each of the feathers; the quill-feathers of the wings and tail black; the sides pale ashy brown; and the upper part of the head and neck black, with a broad patch of white spreading from the throat on either side over the lower part of the cheeks. By this latter character, which is extremely obvious, this species may at all times be readily distinguished. Its bill is black; its iris dark hazel; and its legs and feet grayish-black or lead-coloured. There is little or no distinction in plumage between the two sexes.

Although commonly known by the name of Canada geese, these birds are by no means confined to that country, but extend their migrations from the lowest latitudes of the United States to the highest parallels that have yet been visited in the northern regions of America. Throughout the whole of this vast extent of territory they are familiarly known as the harbingers of spring when passing to the north, and the presage of approaching winter on their return. In the United States it is the popular belief that their journeys are bounded by the great chain of lakes, in the islands of which they are supposed to breed; but even on the shores of Hudson's bay they are still found to be proceeding northwards, and they rarely nest farther south than 60°. Captain Phipps mentions having seen wild geese at Spitzbergen, in more than 80° of latitude; and Wilson deems it "highly probable that they extend their migrations under the very pole itself, amid the silent desolation of unknown countries, shut out since the creation from the prying eye of man by everlasting and insuperable bars of ice."

The passage of the geese to the north commences with the breaking up of the ice, their first appearance in Canada and on the shores of Hudson's bay varying with the forwardness of the spring, from the

middle of April to the latter end of May. Their flight is heavy and laborious, but moderately swift, in a straight line when their number is but few, but more frequently in two lines meeting in a point in front. The van is said to be always led by an old gander, in whose wake the others instinctively follow. But should his sagacity fail in discovering the landmarks by which they usually steer, as sometimes happens in foggy weather, the whole flock appear in distress, and fly about in an irregular manner, making a great clamour. In their flights they cross indiscriminately over land and water, differing in this particular from several other geese, which prefer making a circuit by water to traversing the land. They also pass far inland, instead of confining their course to the neighbourhood of the sea.

So important is the arrival of the geese to the inhabitants of these northern regions that the month in which they first make their appearance is termed by the Indians, as we are informed by Pennant, the Goose Moon. In fact not only the Indians, but the English settlers also, depend greatly upon these birds for their subsistence, and many thousands of them are annually killed, a large proportion of which are salted and barrelled for winter consumption. Many too that are killed on their return, after the commencement of the frost, are suffered to freeze, and are thus kept as fresh provision for several months. Others, either taken young or wounded, are frequently detained in captivity during the winter. They seldom breed in so low a latitude as Churchill river; but Hearne states that he has occasionally met with their eggs in that neighbourhood. The females rarely lay more than four eggs, but the whole number is generally hatched. They are said usually to select an island in preference to the mainland, for the performance of the maternal office in greater safety.

The Spur-winged goose.—Another species of the same group, is the Gambo or Spur-winged goose, a native of northern, and more particularly of western Africa. This bird agrees with the Canadian goose in some of those characters which connect the geese with the swans, but is much more robust in make, and more anserine in general appearance. Its size and proportions are nearly those of the common goose; its legs long, and placed beneath the middle of the body; and its neck of moderate length and proportionate thickness. At the base of the bill, which is broad and flat, it has a tubercle like that of the tame swan, increasing in size with the age of the individual; and the bend of its wings is furnished with a large blunt spur, which appears to be occasionally doubled.

The spur-winged goose was confounded by Willoughby, and afterwards by Buffon, with a variety of the Egyptian goose, equally distinguished by the presence of a spur upon the wing, but differing considerably in the form of its bill, and in its colours. In the former the entire bill and the tubercle at its base are of a dull red; the sides of the head are white; the upper parts of the body black, with a metallic brilliancy; a patch of white, mottled with black spots, occupies the base of each of the wings; and the under parts are white, sometimes marked with indistinct zigzag lines of gray. The legs have an obscure tinge of red; and the spurs of the wings are horn-coloured; but the latter are visible only when the wings are expanded, being concealed at all other times beneath the plumage.

CHAP. XII.

OF THE DUCK, AND ITS VARIETIES.

THE Tame Duck is the most easily reared of all our domestic animals. The very instincts of the young ones direct them to their favourite element; and though they are conducted by a hen, yet they despise the admonitions of their leader.

This serves as an incontestable proof that all birds have their manners rather from nature than education. A falcon pursues the partridge, not because it is taught by the old one, but because its appetites make their importunate call for animal food: the cuckoo follows a very different trade from that which its nurse endeavoured to teach it; and, if we may credit Pliny, in time destroys its instructor: animals of the duck kind also follow their appetites, not their tutor, and come to all their various perfections without any guide. All the arts possessed by man are the result of accumulated experience; all the arts of the inferior animals are self-taught, and scarcely one acquired by imitation.

It is usual with the good women to lay duck-eggs under a hen, because she hatches them better than the original parent would have done. The duck seems to be a heedless inattentive mother; she frequently leaves her eggs till they spoil, and even seems to forget that she is intrusted with the charge: she is equally regardless of them when excluded; she leads them to the pond, and thinks she has sufficiently provided for her offspring when she has shown them the water. Whatever advantages may be procured by coming nearer the house, or attending in the yard, she declines them all; and often lets the vermin, who haunt the waters, destroy them, rather than bring them to take shelter nearer home. The hen is a nurse of a very opposite character: she broods with the utmost assiduity, and generally brings forth a young one from every egg committed to her charge; she does not lead her younglings to the water indeed, but she watchfully guards them when there, by standing at the brink. Should the rat, or the weasel, attempt to seize them, the hen can give them protection: she leads them to the house when tired with paddling, and rears up the supposititious brood, without ever suspecting that they belong to another.

The wild duck differs, in many respects, from the tame; and in them there is still greater variety than among the domestic kinds. Of the tame duck there are not less than ten different sorts; and of the wild, Brisson reckons above twenty. The most obvious distinction between wild and tame ducks is in the colour of their feet: those of the tame duck being yellow, those of the wild duck black. The difference between wild ducks among each other, arises as well from their size as the nature of the place they feed in.

Sea-ducks, which feed in salt-water, and dive much, have a broad bill, bending upwards, a large hind-toe, and a long blunt tail. Pond-ducks, which feed in plashe, have a straight and narrow bill, a small hind-toe, and a sharp-pointed train. The former are called, by our decoy-men, *foreign ducks*; the latter are supposed to be natives of England. It would be tedious to enter into the minute varieties of such a number of birds; all agreeing in the same general figure, the same habits and mode of living, and differing in little more than their size and the colours of their plumage. In this tribe we may rank, as natives of our own European dominions, the Eider duck, which is double the size of a common duck, with a black bill; the Velvet duck, not so large, and with a yellow bill; the Scoter, with a knob at the base of a yellow bill; the tufted duck, adorned with a thick crest; the Scaup duck, less than the common duck, with the bill of a grayish blue colour; the Golden eye, with a large white spot at the corners of the mouth, resembling an eye; the Sheldrake, with the bill of a bright red, and swelling into a knob; the Mallard, which is the stock from whence our tame breed has probably been produced; the Pintail, with the two middle feathers of the tail three inches longer than the rest: the Pochard, with the head and neck of a bright bay; the Widgeon, with a lead-coloured bill, and the plumage of the back marked with narrow black and white undulated lines, but best known by its whistling sound; lastly, the Teal, which is the smallest of this kind, with the bill black, the head and upper part of the neck of a bright bay.—These are the most common birds of the duck kind among ourselves: but who can describe the amazing variety of this tribe if he extends his view to the different quarters of the world? The most noted of the foreign tribe are the Muscovy duck, or, more properly speaking, the Musk duck, so called from a supposed musky smell, with naked skin round the eyes, and which is a native of Africa; the Brazilian duck, that is of the size of a goose, all over black except the tips of the wings; the American Wood duck, with a variety of beautiful colours, and a plume of feathers that falls from the back of the head like a friar's cowl.—These, and twenty others, might be added, were increasing the number of names the way to enlarge the sphere of our comprehension.

All these live in the manner of our domestic ducks, keeping together in flocks in the winter, and flying in pairs in summer, bringing up their young by the water-side, and leading them to their food as soon as out of the shell. Their nests are usually built among heath or rushes, not far from the water, and they lay twelve, fourteen, or more eggs, before they sit: yet this is not always their method; the dangers they continually encounter from their ground situation, sometimes obliges them to change their manner of

building; and their awkward nests are often seen exalted on the tops of trees. This must be a very great labour to perform, as the duck's bill is but ill-formed for building a nest, and giving the materials of which it is composed a sufficient stability to stand the weather. The nest, whether high or low, is generally composed of singular materials. The longest grass mixed with heath, and lined with the bird's own feathers, usually go to the composition: however, in proportion as the climate is colder, the nest is more artificially made, and more warmly lined. In the Arctic regions, nothing can exceed the great care, all of this kind take, to protect their eggs from the intenseness of the weather. While the gull and the penguin kind seem to disregard the severest cold, the duck, in those regions, forms itself a hole to lay in, shelters the approach, lines it with a layer of long grass and clay; within that another of moss; and lastly, a warm coat of feathers or down. The eider duck is particularly remarkable for the warmth of its nest. This bird, which, as was said, is above twice as large as the common duck, and resides in the colder climates, lays from six to eight eggs, making her nest among the rocks or the plants along the sea-shore. The external materials of the nest are such as are in common with the rest of the kind; but the inside lining, on which the eggs are immediately deposited, is at once the softest, warmest, and the lightest substance, with which we are acquainted. This is no other than the inside down which covers the breast of the bird in the breeding season. This the female plucks off with her bill, and furnishes the inside of her nest with a tapestry more valuable than the most skilful artists can produce. The natives watch the place where she begins to build, and, suffering her to lay, take away both the eggs and the nest. The duck, however, not discouraged by the first disappointment, builds and lays in the same place a second time; and this they in the same manner take away: the third time she builds, but the drake must supply the down from his breast to line the nest with: and if this be robbed, they both forsake the place, and breed there no more. This down the natives take care to separate from the dirt and moss with which it is mixed; and though no people stand in more need of a warm covering than themselves, yet their necessities compel them to sell it to the more indolent and luxurious inhabitants of the south for brandy and tobacco.

As they possess the faculties of flying and swimming, so they are in general birds of passage, and, it is most probable, perform their journeys across the ocean, as well on the water as in the air. Those that migrate to this country, on the approach of winter, are seldom found so well-tasted or so fat as the fowls that continue with us the year round: their flesh is often lean, and still oftener fishy; which flavour it has probably contracted in the journey, as their food in the

lakes of Lapland, from whence they descend, is generally of the insect kind.

As soon as they arrive among us, they are generally seen flying in flocks to make a survey of those lakes where they intend to take up their residence for the winter. In the choice of these they have two objects in view; to be near their food, and yet remote from interruption. Their chief aim is to choose some lake in the neighbourhood of a marsh, where there is at the same time a cover of woods, and where insects are found in great abundance. Lakes, therefore, with a marsh on one side and a wood on the other, are seldom without vast quantities of wild-fowl; and where a couple are seen at any time, that is a sufficient inducement to bring hundreds of others. The ducks flying in the air, are often lured down from their heights by the loud voice of the mallard from below. Nature seems to have furnished this bird with very particular faculties for calling. The windpipe, where it begins to enter the lungs, opens into a kind of cavity, where the sound is reflected as in a musical instrument, and is heard a great way off. To this call all the stragglers resort; and in a week or a fortnight's time, a lake, that before was quite naked, is black with water-fowl that have left their Lapland retreats, to keep company with our ducks who never stirred from home.

They generally choose that part of the lake where they are inaccessible to the approach of the fowler, in which they all appear huddled together, extremely busy, and very loud. What it is can employ them all the day it is not easy to guess. There is no food for them at the place where they sit and cabal thus, as they choose the middle of the lake; and as for courtship, the season for that is not yet come; so that it is wonderful what can keep them so busily occupied. Not one of them seems a moment at rest. Now pursuing one another, now screaming, then all up at once, then down again; the whole seems one strange scene of bustle, with nothing to do.

They frequently go off in a more private manner by night to feed in the adjacent meadows and ditches, which they dare not venture to approach by day. In these nocturnal adventures they are often taken; for though a timorous bird, yet they are easily deceived, and every spring seems to succeed in taking them. But the greatest quantities are taken in decoys; which, though well known near London, are yet untried in the remoter parts of the country. The manner of making and managing them is as follows:—

A place is to be chosen for this purpose far remote from the common highway, and all noise of people. A decoy is best where there is a large pond surrounded by a wood, and beyond that a marshy and uncultivated country. When the place is chosen, the pool, if possible, is to be planted round with willows, unless a wood an-

swers the purpose of shading it on every side. On the north and south side of this pool are two, three, or four ditches or channels, made broad towards the pool, and growing narrower till they end in a point. These channels are to be covered over with nets, supported by hooped sticks bending from one side to the other; so that they form a vault or arch growing narrower and narrower to the point, where it is terminated by a tunnel net, like that in which fish are caught in weirs. Along the banks of these channels so netted over, which are called pipes, many hedges are made of reeds slanting to the edge of the channel, the acute angles to the side next the pool. The whole apparatus, also, is to be hidden from the pool by a hedge of reeds along the margin, behind which the fowler manages his operations. The place being fitted in this manner, the fowler is to provide himself with a number of wild ducks made tame, which are called decoys. These are always to be fed at the mouth or entrance of the pipe, and to be accustomed to come at a whistle.

As soon as the evening is set in, *the decoy rises*, as they term it, and the wild fowl feed during the night. If the evening be still, the noise of their wings, during their flight, is heard at a very great distance, and produces no unpleasing sensation. The fowler, when he finds a fit opportunity, and sees his decoy covered with fowl, walks about the pool, and observes into what pipe the birds gathered in the pool may be enticed or driven. Then casting hemp-seed, or some such seed as will float on the surface of the water, at the entrance, and up along the pipe, he whistles to his decoy-ducks, who instantly obey the summons, and come to the entrance of the pipe, in hopes of being fed as usual. Thither also they are followed by a whole flock of wild ones, who little suspect the danger preparing against them. Their sense of smelling, however, is very exquisite; and they would soon discover their enemy, but that the fowler always keeps a piece of turf burning at his nose, against which he breathes, and this prevents the effluvia of his person from reaching their exquisite senses. The wild ducks, therefore, pursuing the decoy-ducks, are led into the broad mouth of the channel or pipe, nor have the least suspicion of the man, who keeps hidden behind one of the hedges. When they have got up the pipe, however, finding it grow more and more narrow, they begin to suspect danger, and would return back; but they are now prevented by the man, who shows himself at the broad end below. Thither, therefore, they dare not return; and rise they may not, as they are kept by the net above from ascending. The only way left them, therefore, is the narrow-funnelled net at the bottom; into this they fly, and there they are taken.

It often happens, however, that the wild-fowl are in such a state of sleepiness or dozing, that they will not follow the decoy-ducks. Use is

then generally made of a dog, who is taught his lesson. He passes backward and forward between the reed-hedges, in which there are little holes, both for the decoy-man to see, and for the little dog to pass through. This attracts the eye of the wild-fowl; who, prompted by curiosity, advance toward this little animal, while he all the time keeps playing among the reeds, nearer and nearer the funnel, till they follow him too far to recede. Sometimes the dog will not attract their attention till a red handkerchief, or something very singular, be put about him. The decoy-ducks never enter the funnel-net with the rest, being taught to dive under water as soon as the rest are driven in.

The general season for catching fowls in decoys is from the latter end of October till February. The taking them earlier is prohibited by an act of George the Second, which imposes a penalty of five shillings for every bird destroyed at any other season.

The Lincolnshire decoys are commonly let at a certain annual rent, from five pounds to twenty pounds a-year; and some even amount to thirty. These principally contribute to supply the markets of London with wild fowl. The number of ducks, widgeon, and teal, that is sent thither is amazing. About thirty thousand have been sent up in one season from ten decoys in the neighbourhood of Wainfleet. This quantity makes them so cheap on the spot, that it is asserted the several decoy-men would be glad to contract for years to deliver their ducks at the next town for tenpence the couple.

To this manner of taking wild-fowl in England, I will subjoin another still more extraordinary, frequently practised in China. Whenever the fowler sees a number of ducks settled in any particular splash of water, he sends off two or three gourds to float among them. These gourds resemble our pompions; but, being made hollow, they swim on the surface of the water; and on one pool there may sometimes be seen twenty or thirty of these gourds floating together. The fowl at first are a little shy of coming near them; but by degrees they come nearer; and as all birds at last grow familiar with a scare-crow, the ducks gather about these, and amuse themselves by whetting their bills against them. When the birds are as familiar with the gourds as the fowler could wish, he then prepares to deceive them in good earnest. He hollows out one of these gourds, large enough to put his head in; and, making holes to breathe and see through, he claps it on his head. Thus accoutred, he wades slowly into the water, keeping his body under, and nothing but his head in the gourd above the surface; and in that manner moves imperceptibly towards the fowls, who suspect no danger. At last, however, he fairly gets in among them; while they, having been long used to see gourds, take not the least fright when the enemy is in the very midst of them; and an insidious enemy

he is; for ever as he approaches a fowl, he seizes it by the legs, and draws it in a jerk under water. There he fastens it under his girdle, and goes to the next, till he has thus loaded himself with as many as he can carry away. When he has got his quantity, without ever attempting to disturb the rest of the fowls on the pool, he slowly moves off again; and in this manner pays the flock three or four visits in a day. Of all the various artifices for catching fowl, this seems likely to be attended with the greatest success, as it is the most practised in China.

SUPPLEMENTARY NOTE.

The tame duck owes its origin to the mallard or wild duck, but has long been reclaimed from a state of nature. Many of them have nearly the same plumage as the wild ones; others vary greatly from them both in plumage and size. They are to be found of all colours; but the drakes still retain the unvarying marks of their wild original, in the curled feathers of the tail. In a wild state they pair and are monogamous, but become polygamous when tame. Buffon says, "man made a double conquest when he subdued the inhabitants at once of the air and the water. Free in both those elements, equally fitted to roam in regions of the atmosphere, to glide through the ocean, or plunge under its billows, the aquatic birds seemed destined by nature to live for ever remote from society and from the limits of our dominion. Eggs taken from the reeds and rushes amidst the water, and set under an adopted mother, first produced in our farm-yards wild, shy, fugitive birds, perpetually roving and unsettled, and impatient to regain the abodes of liberty. These, however, after they had bred and reared their own young in the domestic asylum, became attached to the spot; and their descendants, in process of time, grew more and more gentle and tractable, till at last they appear to have nearly relinquished and forgotten the prerogatives of the savage state, although they still retain a strong propensity to roam abroad, in search, no doubt, of the larger pools, marshy places, and bogs, which it is natural to suppose they prefer to the beaten, hard, pebbly-covered surface surrounding the scantily watered hamlet: and indeed it is well known to every observing good housewife, that when they are long confined to such dry places, they degenerate both in strength and beauty, and lose much of the fine flavour of those which are reared in spots more congenial to their nature. That these and such like watery places, which their health requires for them to wash, dive, feed, rest, and sport in, are not better tenanted by these useful and pretty birds, is much to be regretted, and marks strongly a falling off, a want of industry in those females to whose lot it falls, and whose duty it is to contribute their quota of attention to those lesser but essential branches of rural economy."

When ducks, with other kinds of fowl, are busily employed in picking up the waste about the barn door, they greatly enliven the rural scene, as depicted by our poet Allan Ramsay:

"A snug thack house, before the door a green,
Hens on the middings, ducks in dubs are seen:
On this side stands a barn, on that a byre;
A peat-stack joins, and forms a rural square."

"We have been assured," says Montagu, "by a person of undoubted veracity, that a half-domesticated duck made a nest in Rumford Tower, hatched her young, and brought them in safety to a piece of water at a considerable distance. Others have been known to breed on trees; and we recollect the nest

of this bird being found in the head of an old pollard willow impending over the water, from whence the young might readily drop unhurt into their natural element." Mr. Tunstall, says Professor Rennie, mentions one at Etchingham, in Sussex, which was found sitting upon nine eggs, on an oak twenty-five feet from the ground. Daniel, in his rural sports, mentions an instance of one taking possession of the nest of a hawk in a large oak. Mr. Andrew Shortrede informs us, that he remembers on his father's farm of Monklaw, near Jedburgh, a duck, which in the spring laid black eggs. As the season advanced, the blackness gradually went off, till, at the end of autumn, the eggs were whiter than those of an ordinary duck. This duck was rather beyond the usual size. On the same farm there was another duck, which laid two eggs a-day. This fact was proved by locking the bird up, when one egg was found early in the morning, and another in the evening. This remarkable duck was killed by a servant ignorant of its virtues.

The following curious fact is related by Professor Scarpa.—A duck accustomed to feed out of its owner's hand, was once offered some perfumed bread, which it at first refused to take. After several attempts, however, it at length complied; took the bread in its bill, and carrying it to a neighbouring pond, moved it in various directions, as if to wash away the disagreeable taste and smell, and then swallowed it. Mr. Saul says, "I have now a fine duck, which was hatched under a hen in the spring of 1828, there being seven young ones produced at the time. When these ducks were about ten days old, five of them were taken away from beneath the hen by the rats during the night time, the rats sucking them to death, and leaving the body perfect. My duck, which escaped this danger, now alarms all the other ducks and fowls, in a most extraordinary manner, as soon as the rats appear in the building in which they are confined, whether it be in the night or in the morning. I was awoken by this duck last spring, about midnight; and, as I apprehended the rats were making an attack, I got up immediately, went to the building and found the ducks uninjured. I then returned to bed again, supposing the rats had retreated. To my surprise next morning, I found that ten young ducks had been taken from beneath a hen, and sucked to death at a very short distance from where the duck was sitting. On this account I got a young rat-dog, and kept it in the building; and, when the rats approach, the duck will actually rouse the dog from sleep, and as soon as the dog starts up, the duck becomes settled again."

The *Velvet duck* is an inhabitant of Europe and South America, and is between twenty and twenty-two inches in length. The plumage is blackish; the lower eyelid and spot on the wings white; the bill is yellow, black in the middle, gibbous at the base; the legs are red. The female is without the gibbosity at the bill; her body is brown; and she lays white eggs.

The *Scaup duck* inhabits Europe, Northern Asia, and America: it migrates in winter to warmer climates; its food is shell-fish, and is in length from eighteen to twenty inches. The back and shoulders are cinereously waved; the belly is white; it has also a white spot on each wing. The bill is broad, and of a bluish ash colour; the irides yellow; the head and neck are of a greenish black colour; the back and wing-coverts waved with black and cinereous; the legs and primary quill feathers are dusky; the secondaries are white, tipped with black; the tail covert and the vent are black. The female birds are brown; the bill black, surrounded with a circle of white feathers; the neck rusty; the belly is white; and there is a bar of white on each wing; the legs are black.

The Shieldrake.—This has flat bill, a compressed fore-head, a greenish black head, and the body variegated with white. It is an inhabitant of the northern world as far as Iceland. They usually breed in deserted rabbit-holes, and lay fifteen or sixteen roundish white eggs; and sit about thirty days. "They are very careful of their young," says Latham, "and will carry them from place to place in their bills." They also show much instinctive cunning in preserving them when attempted to be caught; for they will fly along the ground as if wounded, till the brood are got into a place of security. Their great beauty has induced many unsuccessful attempts to domesticate them; but they never thrive, unless in the neighbourhood of salt-water. The eggs are thought good; but the flesh of this bird is rank and unsavoury.

The Mallard is about the size of the preceding; its bill, from the angles of the mouth to the tip, is about two inches and a quarter, and near an inch broad, with a roundish tip at the end; the head and upper part of the neck are of a beautiful shining green; the under eyelids white, with a sort of half circle or white ring that passes round the fore-part of the neck; the under part of the neck below the white ring to the breast, is of a glossy chestnut colour. The under parts of the breast and belly are a sort of ash colour, sprinkled with a variety of dark specks resembling drops; the back between the wings is of a cinereous red, in like manner sprinkled or speckled; the lower part towards the rump still darker; the rump itself of a sort of glossy purple. The sides of the body and the longer thigh feathers are beautified with transverse brown lines, with a bluish sort of mixture. The scapular feathers of the wings are of a fine silver colour, beautifully variegated with brown transverse lines; the second row of the quill feathers tipped with white, with the outward webs of a fine bluish purple, and a border of black running between the white and the blue; the rest of the wings variegated with silver-coloured feathers, with some of their edges black, others of a dark purple. The under part of the tail is black, the feathers on the upper end in sharp points, the middlemost of which turn up in a circular form towards the back, and appear of a fine glossy purple colour. They are feathered down to the knees; the legs and feet are of a saffron colour.

It is towards the middle of October that the wild ducks generally begin to make their appearance among us, but only in small bands, which are in a little time followed by others more numerous. They are recognised by their elevated flight, in inclined lines, or regular triangles. They are observed on their arrival to fly incessantly from one pond and river to others. Their movements are made more by night than by day. They feed, voyage, arrive, and depart principally in the evening, and even at night, during which the whizzing of their flight discovers their passage; but the noise of their wings is greatest at the moment of their setting out. As long as the rigour of the season does not deprive them of aquatic insects, of small fish, of frogs, of the grains of seeds, and other marshy plants, which furnish them with abundant food, they remain in rivers and large pieces of stagnant water; but when these are frozen, they retire to the borders of woods to pick up the acorns, or spread themselves in the fields to feed upon the green corn. If the cold continues, and becomes too rigorous, they depart altogether, and transport themselves into more temperate climates, returning only with the thaw about the month of February. It is usually in the evening that they are seen to repass with the winds from the south; but the bands are less numerous, because at this epoch they commence to pair. Each couple set off separately, remain isolated in the reeds and rushes

the greater part of the day, travel by night, never stop except when impeded by contrary winds, and proceed to the northern regions to pass the summer. Some few couples, however, remain with us, and nestle in marshy grounds. The female usually makes choice of a thick tuft of rushes, of the middle of which she forms a nest by cutting and bending the stems. Such nests are, however, sometimes found in the midst of brushwood at some distance from the water, and these birds have even been known to lay in the nests of others. The eggs are from ten to fifteen, and sometimes even eighteen in number, and of a greenish-white. The mother strips her breast to furnish the nest, and to cover the eggs during her absence. She never alights at less than a hundred paces from the nest, and takes a circuitous route to arrive there, with her eyes constantly watching to see if there are any enemies in the neighbourhood. Once fixed, however, on the eggs, even the approach of man will not oblige her to quit them. The male remains at some distance from his companion, ready to assist and defend her. The incubation lasts thirty days; and as soon as the young are disclosed, the mother conducts them to the water; it is even said, that if they are at some distance from it, the parents bring them there one by one with their bills. The female rallies them in the evening, conceals them in reeds, and covers them with her wings during the night. The small insects, &c. which they can catch on the surface of the water are their first food. They are for some time covered with a yellowish down, and are unable to fly until they are three months old. These birds are exceedingly distrustful, make many circulations before they alight anywhere, swim always at a distance from the shore; and when they sleep upon the water, which they often do, one of them always watches as a sentinel. In consequence of this, the pursuit of them is extremely difficult.

The wild ducks in general prefer the northern regions; but birds of such powerful flight can easily be supposed to pass from one continent to another. We find, in fact, this same species in corresponding climates in the New World; but the American species seems larger and more robust, though in all other respects exactly similar.

The Long-Tailed Duck.—The tail is pointed and long; the body is black; it is whitish beneath. It inhabits Europe, Asia, and America. The bill is black, orange-coloured in the middle; it is reddish gray on the fore-part of the head and sides; hind-part, breast, and belly, white; the scapulars are long and white; on each side of the neck it has a black spot; the lower part of the breast, back, wings, and tail, are of a chocolate colour; the four middle tail feathers are black; the two middle ones longer than the rest; the others are white; the legs are dusky red, or blackish. The female has a shorter tail, and wedged; the body is varied with blackish, rufous and gray; the back is black; collar and lower part of the belly white.

The Golden Eye chiefly breeds in Italy: it has a large head and thick body; the neck short; and the bill broad, elevated towards the point, of a black colour, and is, if measured from the angles of the mouth, about an inch and three quarters long; the head, when variously exposed to the light, appears black, purple, and green, with a fine shining silky gloss; it has a white spot on each side of the mouth; the eyes are of a fine gold colour; the neck, breast, and belly, white; the space between the shoulders and the back is black; the wings of a fine beautiful mixture of black and white; the tail near three inches long; the legs short, of a yellowish colour; the toes pretty long, and more dusky. It has a disagreeable fishy taste; they are sometimes, but very rarely, taken upon the English coast.

The *Eider duck* is principally found in the Western

islands of Scotland, and on the coasts of Norway, Iceland, and Greenland. Its bill is black, and its plumage is a varied mixture of black and white; the female however is of a reddish brown colour, marked with black and dusky streaks. They generally build on small islands, not far from the shore, and the male continues on the watch near the shore while the female is sitting; but he leaves them when the brood is hatched. As soon as they are able to creep from the shell, the mother entices them to the water side, and taking them on her back, she swims a short distance with them; when she has got them a little way from land, she dives suddenly, leaving them floating on the surface of the water to shift for themselves. After this they are seldom found on land. But that which renders this bird so highly valued, is the celebrated eider down, used for the beds and couches of the luxurious and the effeminate. This is plucked from the breast by the birds, in order to line their nests; and during the time that the female is sitting, those who are concerned in the traffic, remove her, and take away the down and superfluous eggs, and then carefully replace her. This is done several times, and the down is again produced by the birds, and she begins to lay afresh; and when the young ones leave the nest, it is completely plundered. One female will give about half a pound of down, which, when properly cleaned, is reduced to one half of that quantity. The down, when cleaned, sells at about 12s. per pound. The Hon. Arthur Dillon in his 'Winter in Iceland,' says: "So much do these interesting birds feel their security in Vidoe, that five of them had chosen as their location the ground under a narrow bench that runs along the windows of the house: and so perfectly fearless were they, that, without moving away, they would peck at the hand that disturbed them. The rising ground is particularly favourable for the birds to build on, being covered with hollows and inequalities, that serve to protect them from the weather, and only require the addition of down to convert them into nests. The drakes are easily known by their white and black plumage; but the dark hue of the females makes it difficult to distinguish them from the holes in which they sit. Owing to their lying close, I have frequently trodden on them, without their warning me of their presence till the mischief was done. The drakes, though by no means wild, will not allow themselves to be handled so freely as the ducks, and mostly keep together on the top of the hill. As soon as a nest is completed, it is usual to remove the greater part of the down, while the bird is away feeding; and this operation is repeated a second, and occasionally a third, time. On her return, the bird makes up the deficiency thus created, by stripping her own breast; and, when her stock is exhausted, she calls on her mate to add his portion, which will bear no comparison with the sacrifice she has made. The same sort of spoliation is practised with regard to the eggs, care being taken that three or four are left; for should the bird on her return find the nest empty, she will desert it, and not breed again the same season. About six, considerably larger than those of tame ducks, and of a light green colour, are found in each nest. Their flavour is very inferior to that of hens' eggs, but they are not so strong as to prevent their being made into omelettes. The average quantity of down obtained from three nests is half a pound, so mixed with grass and foreign matter, that forty pounds in that state are reduced to fifteen, after it has been thoroughly cleaned. Vidoe and Engoe together produce, I believe, about three hundred pounds weight yearly, which would, if the above calculation is correct, make the number of ducks that come to these two places fall not far short of ten thousand every year. The number, however, that breed in Faxefjord is

small, compared to those that bend their course to Breiddefjord."

The example of the eider-duck, in plucking the down from her body in order to keep her offspring warm, is not unmatched in the animal world. The domestic rabbit is a familiar example, preparing for her delicate young a nest of hay, warmly lined with down plucked from her own fur. It may not be so generally known, that several moths, such as the gypsy and the golden tail, are provided with a thick bunch of down on their tails for covering their eggs at the time of laying, and also with a pair of tweezers, likewise situated in the tail, for plucking off this down and spreading it over the eggs.

The Summer-duck.—It has been remarked by Aristotle, that birds which do not perch build on the ground:—"Partridges," he says, "and other birds which seldom fly, nestle on the ground; of these, also, the skylark, the woodcock, and the quail never alight on a tree. But the converse of this will not hold; for many birds which perch nestle on the ground, of which the redbreast, the buntings, and the pheasants, are familiar examples. A very remarkable illustration, however, of the remark of Aristotle occurs in the summer-duck of America, which does not seem out of place to be mentioned here, as one of the birds which line their nests with their own down. At variance with the habits of all other ducks, this one perches on trees, for which its strong sharp claws render it more adapted than its webbed feet. The elegant form and rich colouring of the male (though the female wears a uniform of dull brown) have excited the admiration of all who have seen it; and we think it not unlikely that the Indians took the hint of their plumed head-dresses from its beautiful crest. With this crest and the skin of the neck, the calumet, or pipe of peace, is frequently ornamented. Linnaeus, whose nomenclature exhibits some singular displays of fanciful allusion, imagined that this duck's crest so much resembled the bridal head-dress of his country-women, that he named it the bride, though the one is high, stiff, fantastic, and out of all reasonable proportion, while the other is free, elegant, and graceful. The beautiful pendent crest of the summer-duck arises from a base of glossy golden green, shading off into a rich violet brown, dashed with interrupted streaks of snow white. The feathers covering the wings are of the same glossy brown, which melts into black, with rich purple reflections of burnished steel; while those on the flanks are delicately fringed and striped with black and white.

It is stated in the notes to Buffon, by the English translator, that the summer-duck nestles in the holes bored by the woodpeckers; but this, on considering its size, must appear impossible. That it does, however, make its nest in the holes of trees has been testified by every observer. Wilson informs us that instances have been known in which the nest was constructed with a few sticks laid on the fork of the branches, though it is usually in the inside of a hollow tree, and, as it would appear, very near if not upon the ground. "On the 18th of May," continues Wilson, "I visited a tree containing a nest of a summer-duck, on the banks of Tuckahoe river, New Jersey. It was an old grotesque white oak, whose top had been torn off by a storm. It stood on the declivity of the bank, about twenty yards from the water. In this hollow and broken top, and about six feet down, on the soft decayed wood, lay thirteen eggs, snugly covered with down, doubtless taken from the breast of the bird. This tree had been occupied, probably by the same pair, for four successive years, in breeding-time. The person who gave me the information, and whose house was within twenty or thirty yards of the tree, said that he had seen the female, the preceding spring, carry

down her young, one by one in less than ten minutes. She caught them in her bill by the wing or back of the neck, and landed them safely at the foot of the tree, whence she afterwards led them to the water. Under this same tree, at the time I visited it, a large sloop lay on the stocks nearly finished; the deck was not more than twelve feet distant from the nest, yet, notwithstanding the presence and noise of the workmen, the ducks would not abandon their old breeding-place, but continued to pass out and in as if no person had been near. The male usually perched on an adjoining limb, and kept watch while the female was laying, and also often when she was sitting. A tame goose had chosen a hollow space at the root of the same tree to lay and hatch her young in."

CHAP. XIII.

OF THE KINGFISHER.

I WILL conclude the history of birds with one that seems to unite in itself somewhat of every class preceding. It seems at once possessed of appetites for prey like the rapacious kinds, with an attachment to water like the birds of that element. It exhibits in its form the beautiful plumage of the peacock, the shadings of the humming-bird, the bill of the crane, and the short legs of the swallow. The bird I mean is the King-fisher, of which many extraordinary falsehoods have been propagated; and yet of which many extraordinary things remain to be said that are actually true.

The Kingfisher is not much larger than a swallow; its shape is clumsy; the legs disproportionately small, and the bill disproportionately long: it is two inches from the base to the tip; the upper chap black, and the lower yellow: but the colours of this bird atone for its inelegant form; the crown of the head and the coverts of the wings are of a deep blackish green, spotted with bright azure; the back and tail are of the most resplendent azure; the whole under-side of the body is orange-coloured; a broad mark of the same passes from the bill beyond the eyes; beyond that is a large white spot; the tail is short, and consists of twelve feathers of a rich deep blue; the feet are of a reddish yellow, and the three joints of the outmost toe adhere to the middle toe, while the inner toe adheres only by one.

From the diminutive size, the slender short legs, and the beautiful colours of this bird, no person would be led to suppose it one of the most rapacious little animals that skims the deep. Yet it is for ever on the wing, and feeds on fish, which it takes in surprising quantities, when we consider its size and figure. It chiefly frequents the banks of rivers, and takes its prey after the manner of the osprey, balancing itself at a certain distance above the water for a considerable space, then darting into the deep, and seizing the fish with inevitable certainty. While it re-

mains suspended in the air, in a bright day, the plumage exhibits a beautiful variety of the most dazzling colours. It might have been this extraordinary beauty that has given rise to fable; for whenever there is anything uncommon, fancy is always willing to increase the wonder.¹

Of this bird it has been said, that she built her nest on the water, and thus, in a few days, hatched and produced her young. But, to be uninterrupted in this task, she was said to be possessed of a charm to allay the fury of the waves; and during this period the mariner might sail with the greatest security. The ancient poets are full of these fables; their historians are not exempt from them. Cicero has written a long poem in praise of the halcyon, of which there remain but two lines. Even the emperor Gordian has written a poem on this subject, of which we have nothing remaining. These fables have been adopted each by one of the earliest fathers of the church. "Behold," says St. Ambrose, "the little bird, which in the midst of winter lays her eggs on the sand by the shore. From that moment the winds are hushed; the sea becomes smooth; and the calm continues for fourteen days. This is the time she requires; seven

¹ The Kingfisher, although one of the least elegantly formed of our native birds, is among the most distinguished for the beauty of its plumage, which is such as at once to recall to mind the splendour of the feathered denizens of the tropics. Its large body, short and thick neck, disproportionately long bill, diminutive feet, and abbreviated tail, give it a peculiar appearance, so that the least observant cannot mistake it for any other bird. The bill is considerably longer than the head, straight, rather slender, higher than broad in its whole length, four-sided, its outlines almost straight, and its tip pointed. The very short tarsi are roundish, and destitute of defined scales; the first toe shorter than the second, the third slightly longer than the fourth; the claws arched, slender, compressed, and acute. The plumage is soft and blended; the feathers generally long, especially on the hind-neck and rump; of an oblong form, without plumules. The wings are rather short, but very broad, the secondary quills being of great length; the tail very short, a little rounded, of twelve rather narrow, rounded feathers. The upper mandible is dark brown, as are the margins and tip of the lower, the remaining part being pale orange. The tarsi and toes are orange-red, the claws dark-brown. The upper part of the head is dull-green, each feather with a transverse bar of light greenish-blue near the end; the hind-neck, sides of the back, scapulars, and wing-coverts, are of a similar dull green, tinged with purple in a different light, the latter feathers tipped with light blue. The middle of the back, the rump, and tail-coverts, are of a beautiful glossy light blue, the tail of a duller purplish-blue. The quills are brown, with the outer webs dull-green. A band of yellowish-red from the nostril to the eye; the loreal space dusky; behind the eye a similar yellowish-red band; below which, and extending from the lower mandible, is a band of greenish-blue, terminating behind in a yellowish-white patch. The throat is of the latter colour, and the rest of the lower parts yellowish-red, of a richer tint anteriorly. The length is 7½ inches. The female is somewhat smaller, but similar in the colour, the tints being only a little less bright.—Ed

days to hatch, and seven days to foster her young. Their Creator has taught these little animals to make their nest in the midst of the most stormy season, only to manifest his kindness by granting them a lasting calm. The seamen are not ignorant of this blessing; they call this interval of fair weather their halcyon days; and they are particularly careful to seize the opportunity, as they then need fear no interruption." This, and a hundred other instances, might be given of the credulity of mankind with respect to this bird; they entered into speculations concerning the manner of her calming the deep, the formation of her nest, and her peculiar sagacity; at present we do not speculate because we know, with respect to our kingfisher, that most of the facts are false. It may be alleged, indeed, with some show of reason, that the halcyon of the ancients was a different bird from our kingfisher; it may be urged, that many birds, especially on the Indian ocean, build a floating nest upon the sea; but still the history of the ancient halcyon is clogged with endless fable; and it is but an indifferent method to vindicate falsehood, by showing that a part of the story is true.

The kingfisher with which we are acquainted at present, has none of those powers of allaying the storm, or building upon the waves; it is contented to make its nest on the banks of rivers, in such situations as not to be affected by the rising of the stream. When it has found a place for its purpose, it hollows out with its bill a hole about a yard deep; or if it finds the deserted hole of a rat, or one caused by the root of a tree decaying, it takes quiet possession. This hole it enlarges at the bottom to a good size; and lining it with the down of the willow, lays its eggs there without any further preparation.

Its nest, or rather hole, is very different from that described by the ancients, by whom it is said to be made in the shape of a long-necked gourd of the bones of the sea-needle. The bones, indeed, are found there in great quantities, as well as the scales of fishes; but these are the remains of the bird's food, and by no means brought there for the purposes of warmth and convenience. The kingfisher, as Bellonius says, feeds upon fish, but is incapable of digesting the bones and scales, which he throws up again, as eagles and owls are seen to do a part of their prey. These fill the bird's nest of course; and although they seem as if designedly placed there, are only a kind of nuisance.

In these holes, which, from the remains of fish brought there, are very fetid, the kingfisher is often found with from five eggs to nine. There the female continues to hatch, even though disturbed; and though the nest be robbed, she will again return and lay there. "I have had one of those females brought me," says Reaumur, "which was taken from her nest about three leagues from my house. After admiring the beauty of her colours, I let her fly again, when

the fond creature was instantly seen to return back to the nest where she had just before been made a captive. There, joining the male, she again began to lay, though it was for the third time, and though the season was very far advanced. At each time she had seven eggs. The older the nest is, the greater quantity of fish-bones and scales does it contain: these are disposed without any order; and sometimes take up a good deal of room."

The female begins to lay early in the season: and excludes her first brood about the beginning of April. The male, whose fidelity exceeds even that of the turtle, brings her large provisions of fish while she is thus employed; and she, contrary to most other birds, is found plump and fat at that season. The male, that used to twitter before this, now enters the nest as quietly and as privately as possible. The young ones are hatched at the expiration of twenty days; but are seen to differ as well in their size as in their beauty.

As the ancients have had their fables concerning this bird, so have the modern vulgar. It is an opinion generally received among them, that the flesh of the kingfisher will not corrupt, and that it will even banish all vermin. This has no better foundation than that which is said of its always pointing, when hung up dead, with its breast to the north. The only truth which can be affirmed of this bird, when killed, is, that its flesh is utterly unfit to be eaten; while its beautiful plumage preserves its lustre longer than that of any other bird we know.

Having thus given a short history of birds, I own I cannot take leave of this most beautiful part of the creation without reluctance. These splendid inhabitants of the air possess all those qualities that can soothe the heart and cheer the fancy: the brightest colours, the roundest forms, the most active manners, and the sweetest music. In sending the imagination in pursuit of these, in following them to the chirping grove, the screaming precipice, or the glassy deep, the mind naturally lost the sense of its own situation, and, attentive to their little sports, almost forgot the task of describing them. Innocently to amuse the imagination in this dream of life is wisdom; and nothing is useless that, by furnishing mental employment, keeps us for a while in oblivion of those stronger appetites that lead to evil. But every rank and state of mankind may find something to imitate in those delightful songsters, and we may not only employ the time, but mend our lives, by the contemplation. From their courage in defence of their young, and their assiduity in incubation, the coward may learn to be brave, and the rash to be patient. The inviolable attachment of some to their companions may give lessons of fidelity; and the connubial tenderness of others be a monitor to the incontinent. Even those that are tyrants by nature never spread capricious destruction; and, unlike

man, never inflict a pain but when urged by necessity.

SUPPLEMENTARY NOTE.

Every schoolboy is acquainted with the story in Ovid's *Metamorphoses*, of Ceyx, king of Magnesia, being shipwrecked, and of his queen, Alcyon (fabled to be the daughter of the wind), who flung herself from a cliff overhanging the sea, that she might be drowned as well as her husband; but, instead of perishing, both were changed into kingfishers: as Dryden gives it,

"The gods their shape to winter birds translate,
But both obnoxious to their former fate.
Their conjugal affection first is tried,
And still the mournful race is multiplied."

The description of this bird by Aristotle is both luminous and accurate. "The halcyon," says he, "is not much larger than a sparrow; its plumage is painted with azure and green, slightly tinged with purple,—these colours not being distinct, but blending into one another; and shining in an iridescent manner over the whole body, the wings, and the neck; the bill is greenish yellow (*ὀπρὸς λαγρός*), long and slender." Pliny has in part followed Aristotle, but has introduced more details of the notions prevalent respecting the bird among the ancients.

With respect to the vocal powers of any species of halcyon, it is probable that Pliny, and those he copied from, confounded it with the sedge-bird, with the dipper, or some other water-songster, whose manner it is to sing concealed; while the halcyon, perched on some leafless twig overhanging the water, being easily perceived, acquired credit for what she was incapable of performing. It was supposed by Belon—and perhaps correctly—that the musical halcyon was the river nightingale, or reed-thrush, which is reported to be a pertinacious songster, and creeps about amongst water-plants in pursuit of insects; but Belon is wrong in supposing it the only river-bird which sings.

Wilson's description of the *Belted kingfisher*, though differing in a few points from the common halcyon of Europe, comes much nearer the reality than the fables of the old poets and naturalists. "Like the love-lorn swains," says he, "of whom poets tell us, he delights in murmuring streams and falling waters; not, however, merely that they may soothe his ear, but for a gratification somewhat more substantial. Amidst the roar of the cataract or over the foam of a torrent, he sits perched upon an overhanging bough, glancing his piercing eye in every direction below for his scaly prey, which with a sudden circular plunge he sweeps up from their native element and swallows in an instant. His voice, which is not unlike the twirling of a watchman's rattle, is naturally loud, harsh, and sudden; but is softened by the sound of the brawling streams and cascades among which he generally rambles. He courses along the windings of the brook or river, at a small height above the surface, sometimes suspending himself by the rapid action of his wings like certain species of hawks, ready to pounce on the fry below; now and then settling on an old dead overhanging limb to reconnoitre. Mill-dams are particularly visited by this feathered fisher; and the sound of his pipe is as well-known to the miller as the rattling of his own hopper."

It is easy to be conceived how the kingfisher might be mistaken for a bird of song. But the fancy of the halcyon's ruling the weather after the manner assumed by the philosopher in the tale of *Rasselas* is so extravagant, that we cannot but smile at Montaigne, who seriously believes that "nature has honoured no other animal so much during its sitting and

disclosing, for that the whole ocean is stayed, made stable and smoothed without waves, without winds or rain, whilst the halcyon broods upon her young, which is just about the winter-solstice,—so that, by her privilege, we have seven days and seven nights, in the very heart of winter, wherein we may sail without danger." Old Montaigne is equally undoubting in his faith as to the wonderful construction of the halcyon's nest. "The most inquisitive into the secrets of nature could never yet arrive at the knowledge of the wonderful fabric and architecture where-with the halcyon builds her nest for her little ones, nor guess at the matter. Plutarch who has seen and handled many of them, thinks 'it is the bones of some fish, which with her beak and no other instrument she joins and binds together, interlacing them some lengthwise, others across, and adding ribs and hoops in such manner, that she forms at last a round vessel fit to launch, which being done, and the building finished, she carries it to the edge of the sea-beach, where the waves beating gently against it, shows her where to mend what is not well-joined and knit, and where better to fortify the seams that are leaky and open at the beating of the waves, and, on the contrary, what is well-built and has had due finishing, the beating of the waves does so close and bind together, that it is not to be broken or cracked, by blows either of stone or iron, without a great deal of trouble. What is still more to be admired is the proportion and figure of the cavity within, which is composed and proportioned after such a manner that it is not possible to receive or admit any other thing save the bird which built it, for to everything else it is so impenetrable, close and shut, that nothing can enter, not even the water of the sea.' See here," adds Montaigne, "a very clear description of this building, and borrowed from a very good hand, and yet methinks it does not give a sufficient light into the difficulty of this architecture."

To us, says Mr. Rennie in his '*Architecture of Birds*,' it appears that what Plutarch took for the nest of the halcyon was simply the crustaceous covering of some of the sea-urchins (*Echinidae*), which agree in most particulars with his description. The most common of the shells, perhaps, is the edible one (*Echinus esculentus*) found on sea-rocks near low-water mark, and varying in size from that of a small orange to nearly that of a cocoa-nut, and in colour from almost white to reddish-orange. When alive, or recent and uninjured, it is covered with numerous blunt spines disposed in rows, but frequently crossing each other at various angles, so as to give some colour to Plutarch's notion of interlacing, and the comparison of Ælian to basket-making, while the whole crust, readily separating into five triangular sections, doubtless gave rise to the notion of "ribs and hoops," particularly as these sections are themselves marked with ribs. The peculiar closure of the mouth also appears to have suggested the wonders respecting the exclusion of sea-water, and the mouth (always on the under part) is furnished with five teeth, not placed in line nor in jaws, but disposed circularly, in a frame which has been denominated Diogenes' lantern, and meeting in a central point.

Belon, who found the kingfisher plentiful on the banks of the Hebrus, in Thrace, appears to have been the first author who correctly stated that it makes its nest by mining into the sand, and was somewhat fearful that he should not be credited because he had contradicted the ancients. Up to the present time, however, more or less misrepresentation has been introduced into the descriptions of its burrow. Gesner furnishes it with a soft bed of reed flowers; Goldsmith says it lines its hole with the down of the willow; and colonel Montagu, half reverting to the ball of fish bones described by Aristotle, tells us that at the end of the hole there is a

kind of bedding formed of the bones of small fish and some other substances, evidently the castings of the parent birds, generally about half an inch thick, and mixed in with the earth. He farther thinks there is every reason to suppose that both the male and the female come to this spot to eject the refuse of their food for some time before the latter begins to lay, and that they dry it by the heat of their bodies, as they are frequently known to continue in the hole for hours long before laying; and on this disgorged matter the female deposits and hatches her eggs. Belon's account is very similar. From the high authority of Montagu, the latter description is now copied as authentic by every modern author, with the exception of Temminck, who says nothing on the subject, and Wilson, who says of his belted kingfisher, that "its nest is neither constructed of glue nor fish-bones." We are certain, says Mr. Rennie, "that this contradiction of the general belief will apply equally to the kingfisher of England. In the bank of a stream at Lee, in Kent, we have been acquainted with one of these nests in the same hole for several successive summers, but so far from the relics of fish-bones, ejected as is done by all birds of prey, being dried on purpose to form the nest, they are scattered about the floor of the hole in all directions, from its entrance to its termination, without the least order or working up with the earth, and are all moist and fetid. That the eggs may by accident be laid upon portions of these fish-bones, is highly probable, for the floor is so thickly strewn with them, that no vacant spot might be found; but they assuredly are not by design built into a nest. The hole is from two to four feet long, sloping upwards, and narrow at the entrance, but widening in the interior, in order, perhaps, to give the birds room to turn; and for the same apparent reason the eggs are not placed at the extremity. We are somewhat doubtful whether it selects, as is said, the old hole of a water-rat to save itself trouble, the water-rat being the deadly enemy of its eggs and young; but it seems to indicate a dislike to the labour of digging, that it frequents the same hole for a series of years, and will not abandon it, though the nest be repeatedly plundered. The accumulation of cast bones in one of these old holes has perhaps given origin to the notion of the nest being formed of them. Our own opportunities," continues Mr. Rennie, "of carefully studying the habits of this bird, leads us to remark, that it is not so very shy and solitary as it has been represented, for it has more than once allowed us to approach within a few yards of the bough on which it was perched. Mr. Jennings says that it is 'rarely if ever found near the habitations of man.' On the contrary, we are in the habit of seeing kingfishers very often on the banks of a brook which runs past our garden, not a hundred yards from the house. A kingfisher's nest was found with young last summer on the bank of the same brook, and within gun-shot of a whole row of houses. This fact was stated in the 'Magazine of Natural History.' Another correspondent of Mr. Loudon's says, 'that for the last nine years, and perhaps more, I have observed that a pair of kingfishers have uniformly constructed their nests in a hole of a bank which projects over a piece of water, on my premises, not one hundred yards from the house.' In the summer of 1828, a single kingfisher took up his abode at Stamford Hill, in the immediate neighbourhood of London, in a narrow garden, much frequented, and close to several houses, on occasion of a small pond being stocked with gold-fish. The bird was frequently seen perched upon an ornament in the middle of the pond watching the fish, and was at last shot by the gardener from an apprehension he would destroy the young fry. The necessity for obtaining its food from streams and shallow ponds causes this

bird, however, to frequent secluded places. The belted kingfisher of America, as we have already seen, is partial to mill-dams, in defiance of the clack of the hopper, because there he finds facilities in watching for fish."

It may be interesting, as a sequel to the fancies of the ancients which we have noticed, to mention one or two modern superstitions respecting the kingfisher. "I have once or twice," says Mrs. Charlotte Smith, "seen a stuffed bird of this species hung up to the beam of a cottage ceiling, and imagined that the beauty of the feathers had recommended it to this sad pre-eminence, till, on inquiry, I was assured that it served the purpose of a weather vane; and though sheltered from the immediate influence of the wind, never failed to show every change by turning its beak to the quarter whence the wind blew." This was an old superstition, for Shakspeare, speaking of sycophants, says, they

"Turn their halcyon beaks
With every gale and vary of their masters."

The learned but somewhat credulous author of the 'Physice Curiose,' asserts the same upon the testimony of his own observation. "Father Athanasius Kircher," he says, "had one of those birds sent him in a present by a friend, and being disembowelled and dried, it was suspended from the ceiling of his celebrated museum from 1640 to 1655, when I left Rome, and though all the doors and windows were shut, it constantly turned its bill towards the wind; and this I myself observed with admiration and pleasure almost every day for the space of three years." It would be useless to follow the author in the fanciful philosophy by which he pretends, after Kircher, the possessor of the bird, to account for the phenomenon; for, notwithstanding his personal testimony, the whole story is evidently no less fabulous than the tradition of the dried body of the same bird having the property of preserving cloth and woollen stuffs from the moth, which once induced drapers to hang it up in their shops. But this is nothing to the pretended power of the lifeless skin of averting thunder, augmenting hidden treasure, bestowing grace and beauty on the person who carries it, and renewing its plumage each season of moulting.

Gmelin tells us that the Tartars pluck the feathers from a kingfisher, "cast them into the water, and carefully preserve such as float, pretending that, if with one of these feathers they touch a woman, or even her clothes, she must fall in love with them. The Ostiaks take the skin, the bill, and the claws of this bird, shutting them up in a purse, and so long as they preserve this sort of amulet they believe they have no ill to fear. The person who taught me this means of living happy could not forbear shedding tears while he told me that the loss of a kingfisher's skin had caused him to lose both his wife and his goods." Forster, our navigator, records a similar superstition in the people of Ulitea.

With a few paragraphs from Mr. Macgillivray's account of this beautiful bird, we shall conclude the present note: "Let us now imagine," says that enthusiastic and most accurate naturalist, "let us now imagine ourselves on the banks of the Esk, the woods resuming their green mantle, and the little birds chanting their summer songs. From afar comes the murmur of the waterfall, swelling and dying away at intervals, as the air becomes still, or the warm breezes sweep along the birchen thickets, and ruffle the bosom of the pebble-paved pool, margined with alders and willows. On the flowery bank of the stream, beside his hole, the water-rat nibbles the tender blades; and on that round white stone in the rapid is perched the dipper, ever welcome to the sight, with his dusky mantle and snowy breast. Slowly along the pale blue sky sail the white fleecy

clouds; as the lark, springing from the field, flutters in ecstasy over his happy mate, crouched upon her eggs under the shade of the long grass, assured that no rambling urchin shall invade her sanctuary. But see, perched on the stump of a decayed willow jutting out from the bank, stands a kingfisher, still and silent, and ever watchful. Let us creep a little nearer, that we may observe him to more advantage. Be cautious, for he is shy, and seeks not the admiration which his beauty naturally excites. There he is grasping the splint with his tiny red feet, his bright blue back glistening in the sunshine, his ruddy breast reflected from the pool beneath, his long dagger-like bill pointed downwards, and his eye intent on the minnows that swarm among the roots of the old tree that project into the water from the crumbling bank. He stoops, opens his wings a little, shoots downwards, plunges headlong into the water, reappears in a moment, flutters, sweeps off in a curved line, wheels round, and returns to his post. The minnow in his bill he beats against the decayed stump until it is dead, then tossing up his head swallows it, and resumes his ordinary posture, as if nothing had happened. Swarms of insects flutter and gambol around, but he heeds them not. A painted butterfly at length comes up, fluttering in its desultory flight, and as it hovers over the hyacinths, unsuspecting of danger, the kingfisher springs from his perch, and seizing it returns to his post. There, swift as the barbed arrow, darting straight forward, on rapidly moving pinions, gleams his mate, who alights on a stone far up the stream, for she has seen us, and is not desirous of our company. He presently follows, and our watch being ended, we may saunter a while along the grassy slopes, inhaling the fragrance of the primrose, and listening to the joyous notes of the blackbird, that from the summit of yon tall tree pours forth his soul in music.

"It is chiefly by the still pools of rivers and brooks that the kingfisher is met with. Although not plentiful in any part of this country, nor any where gregarious, is generally dispersed in England, and occurs in the southern and part of the middle division of Scotland, but has not, I believe, been met with beyond Inverness, for the kingfishers, so called, of the North, are merely dippers. It remains with us all the year, shifting its station on the streams, and in summer selecting some place having a steep bank, in a hole in which it deposits its eggs.

"The question as to its nestling in a water-rat's hole can be decided only by observation. Its bill is certainly adapted for digging into earth or sand, but its feet, one might suppose, would prove very inadequate instruments for scraping out the debris along a tunnel of three or four feet. On the other hand, its hole is often at a greater height from the water than we ever find that of the water-rat; in one case it has been seen twelve feet above it; and all accounts agree in describing it as straight and

sloping upwards, whereas the holes of water-rats are usually tortuous. It is possible enough that sometimes the kingfisher may take possession of a water-rat's hole, or even that of a common rat or mole, and enlarge it—as the starling has been known to do—and that it may also dig a hole for itself, like the bank-swallow. At all events, we have certain evidence that the American kingfisher (*Alcedo Alcyon*) digs its hole. Mr. Audubon states that 'the male and female, after having fixed upon a proper spot, are seen clinging to the bank of the stream in the manner of woodpeckers. Their long and stout bills are set to work, and as soon as the hole has acquired a certain depth, one of the birds enters it, and scratches out the sand, earth, or clay, with its feet, striking meanwhile with its bill to extend the depth. The other bird all the while appears to cheer the labourer, and urge it to continue its exertions; and, when the latter is fatigued, takes its place. Thus, by the co-operation of both, the hole is dug to the depth of four, five, or sometimes six feet, in a horizontal direction, at times not more than eighteen inches below the surface of the ground, at others eight or ten feet.'

"The flight of the kingfisher is direct and rapid, performed by quick beats of the wings, and very similar to that of the dipper, which it, however, excels in speed. The movements of the wings are indeed so rapid that one can scarcely perceive them, and the flight of this bird, the dipper, auks, guillemots, and other short-winged birds, might induce the closet-naturalists to revise their opinions as to flight, founded merely upon the length and breadth of wings: for a long wing is not always so well adapted for speed as a short one, and a guillemot can easily outstrip a gull. Its feet are not adapted for walking or hopping, and therefore it takes its stand on a stone, a stump, a rail, or a branch overhanging the water, waits with patience; and when a minnow or a stickle-bat comes near the surface, darts upon it and secures it. In like manner it sallies forth in pursuit of the larger insects. Although very shy, insomuch that one can very seldom get within shot of it when perched, it does not shun the vicinity of human habitations, but, on the contrary, often breeds at no great distance from them. It does not associate with any other birds, and it is seldom that even two of its own species are seen together. Being highly prized by collectors and others, it is much harassed, and although nowhere plentiful, may be obtained in almost any district to the south of the Forth and Clyde. In some places they leave the larger streams in autumn, and betake themselves to the brooks, so that a person not aware of their habits in this respect might suppose them to be migratory. Even in the more northern parts, however, they remain all the year, and many individuals have been shot near Edinburgh in December and January."

**A HISTORY OF
THE EARTH AND ANIMATED NATURE.**

**PART FOURTH.
HISTORY OF ANIMATED NATURE.
FISHES.**

BOOK I.	Of Cetaceous Fishes,	-	-	-	-	-	-
BOOK II.	Of Cartilaginous Fishes,	-	-	-	-	-	-
BOOK III.	Of Spinous Fishes,	-	-	-	-	-	-
BOOK IV.	Of Crustaceans and Testaceous Fishes,	-	-	-	-	-	-



































PLATE XXXVIII



























HISTORY OF ANIMATED NATURE.

PART FOURTH.—OF FISHES.

BOOK I.

OF CETACEOUS FISHES.

CHAP. I.

INTRODUCTORY.

THE ocean is the great receptacle of fishes. It has been thought, by some, that all fish are naturally of that salt element; and that they have mounted up into fresh water by some accidental migration. A few still swim up rivers to deposit their spawn; but of the great body of fishes, of which the size is enormous, and the shoals are endless, those all keep to the sea, and would quickly expire in fresh water. In that extensive and undiscovered abode, millions reside, whose manners are a secret to us, and whose very form is unknown.¹ The curiosity of mankind, indeed, has drawn some from their depths, and his wants many more: with the figure of these at least he is acquainted; but for their pursuits, migrations, societies, antipathies, pleasures, times of gestation, and manner of bringing forth, these are all hidden in the turbulent element that protects them.

The number of fish to which we have given

¹ It is believed that at great depths in the ocean, animal life ceases to exist, and that fishes are not to be found where the water is excessively deep. It has been satisfactorily proved that fishes have certain limits in high stations. Raymond ascertained that the only fishes which occur in the waters of the Pyrenees, at the height of from 1,000 to 1,162 toises, are three species of trout. Higher up, all fishes disappear. The water salamander also ceases to live at the height of 1,292 toises;—probably because the higher lakes are generally half the year covered with ice. But cold is not the sole cause, as Humboldt says, that in the equatorial regions of America, where the freezing point of water begins 1,500 toises higher than in the Pyrenees, the fishes disappear earlier in the lakes and rivers. No trouts occur in the Andes. Under the equator, from 1,800 to 1,900 toises, where most of the lakes scarcely freeze any time during the year, fishes are no longer met with, with the exception of the remarkable *Peinelodes Cyclopum*, which are thrown out in thousands with the clay-mud, projected from fissures of the rocks at the height of 2,500 toises. But these fishes live in the subterranean lakes.—Ed.

names, and of the figure, at least, of which we know something, according to Linnæus, are above four hundred.² Thus to appearance, indeed, the history of fish is tolerably copious; but when we come to examine, it will be found that of the greatest part of these we know very little. Those qualities, singularities, or advantages, that render animals worth naming, still remain to be discovered. The history of fishes, therefore, has little in it entertaining: for our philosophers hitherto, instead of studying their nature, have been employed in increasing their catalogues; and the reader, instead of observations or facts, is presented with a long list of names, that disgust him with their barren superfluity. It must displease him to see the language of science increasing, while the science itself has nothing to repay the increasing tax laid upon his memory.

Most fish offer us the same external form; sharp at either end, and swelling in the middle; by which they are enabled to traverse the fluid which they inhabit, with greater celerity and ease. That peculiar shape which Nature has granted to most fishes, we endeavour to imitate in such vessels as are designed to sail with the greatest swiftness: however, the progress of a machine moved forward in the water by human contrivance, is nothing to the rapidity of an animal destined by nature to reside there. Any of the large fish overtake a ship in full sail with great ease, play round it without effort, and outstrip it at pleasure. Every part of the body seems exerted in this despatch; the fins, the tail, and the motion of the whole back-bone, assist progression; and it is to that flexibility of body at which art cannot arrive, that fishes owe their great velocity.

The chief instrument in a fish's motion, are the fins, which, in some fish, are much more numerous than in others. A fish completely fitted for sailing, is furnished with not less than two

² About 1,500 species of fish are now known, and of this number about 200 are found on the coast or in the inland waters of Britain.—Ed.

pair; also three single fins, two above and one below. Thus equipped, it migrates with the utmost rapidity, and takes voyages of a thousand leagues in a season. But it does not always happen that such fish as have the greatest number of fins have the swiftest motion; the shark is thought to be one of the swiftest swimmers, yet it wants the ventral or belly fins; the haddock does not move so swift, yet it is completely fitted for motion.

But the fins serve not only to assist the animal in progression, but in rising or sinking, in turning, or even leaping out of the water. To answer these purposes, the pectoral fins serve, like oars, to push the animal forward; they are placed at some little distance behind the opening of the gills; they are generally large and strong, and answer the same purposes to the fish in the water, as wings do to a bird in the air. With the help of these, and by their continued motion, the flying fish is sometimes seen to rise out of the water, and to fly above a hundred yards; till, fatigued with its exertions, it is obliged to sink down again. These also serve to balance the fish's head, when it is too large for the body, and keep it from tumbling down to the bottom, as is seen in large-headed fishes, when the pectoral fins are cut off. Next these are seen the ventral fins, placed towards the lower part of the belly; these are always seen to lie flat on the water, in whatever situation the fish may be; and they serve rather to raise or depress the fish in its element, than to assist progressive motion. The dorsal fin is situated along the ridge of the back; and serves to keep it in equilibrio, as also to assist its progressive motion. In many fishes this is wanting; but in all flat fishes it is very large, as the pectoral fins are proportionably small. The anal fin occupies that part of the fish which lies between the anus and the tail; and this serves to keep the fish in its upright or vertical situation. Lastly, the tail, which in some fishes is flat, and upright in others, seems the grand instrument of motion; the fins are but all subservient to it, and give direction to its great impetus, by which the fish seems to dart forward with so much velocity. To explain all this by experiment; a carp is taken, and put into a large vessel. The fish, in a state of repose, spreads all its fins, and seems to rest upon its pectoral and ventral fins near the bottom; if the fish folds up (for it has the power of folding) either of its pectoral fins, it inclines to the same side; folding the right pectoral fin, the fish inclines to the right side; folding the left fin, it inclines to that side in turn. When the fish desires to have a retrograde motion, striking with the pectoral fins, in a contrary direction, effectually produces it. If the fish desires to turn, a blow from the tail sends it about; but if the tail strikes both ways, then the motion is progressive. In pursuance of these observations, if the dorsal and ventral fins be cut off, the fish reels to the right and

left, and endeavours to supply its loss by keeping the rest of its fins in constant employment. If the right pectoral fin be cut off, the fish leans to that side; if the ventral fin on the same side be cut away, then it loses its equilibrium entirely. When the tail is cut off, the fish loses all motion, and gives itself up to where the water impels it.³

From hence it appears, that each of these instruments has a peculiar use assigned it; but, at the same time, that they all conspire to assist each other's motions. Some fish are possessed of all, whose motions are yet not the swiftest; others have but a part, and yet dart in the water with great rapidity. The number, the size, and the situation of the fins, therefore, seem rather calculated to correspond with the animal's figure than solely to answer the purposes of promoting its speed. Where the head is large and heavy, there the pectoral fins are large, and placed forward, to keep it from oversetting. Where the head is small, or produced out into a long beak, and therefore not too heavy for the tail, the pectoral fins are small, and the ventral fins totally wanting. As most animals that live upon land are furnished with a covering to keep off the injuries of the weather, so all that live in the water are covered with a slimy glutinous matter, that, like a sheath, defends their bodies from the immediate contact of the surrounding fluid. This substance may be considered as a secretion from the pores of the animal's body; and serving not only to defend, but to assist the fish's easy progress through the water. Beneath this, in many kinds, is found a strong covering of scales, that, like a coat of mail, defend it still more powerfully; and under that, before we come to the muscular parts of the body, an oily substance, which supplies the requisite warmth and vigour.

The fish thus protected and fitted for motion

³ The side-fins of fishes seem to be chiefly used to poise them; as they turn upon their backs immediately when killed; the air-bladder assists them perhaps to rise or descend, by its possessing the power to condense the air in it by muscular contraction; and it is possible, that at great depths in the ocean the air in this receptacle may by the great pressure of the incumbent water become condensed into so small a space, as to cease to be useful to the animal. The progressive motion of fish beneath the water is produced principally by the undulation of their tails. One oblique plane of a part of the tail on the right side of the fish strikes the water at the same time that another oblique plane strikes it on the left side, hence, in respect to moving to the right or left, these percussions of the water counteract each other, but they coincide in respect to the progression of the fish; this power seems better applied to push forwards a body in water, than the oars of boats, as the particles of water recede from the stroke of the oar, whence the comparative power acquired is but as the difference of velocity between the striking oar and the receding water. So a ship moves swifter with an oblique wind than with a wind of the same velocity straight behind it; and the common wind-mill sail placed obliquely to the wind, is more powerful than one which directly recedes from it.—Ed.

in its natural element, seems as well furnished with the means of happiness as quadrupeds or birds; but if we come to examine its faculties more nearly, we shall find it very much their inferior. The sense of touching, which beasts and birds have in a small degree, the fish, covered up in its own coat of mail, can have but little acquaintance with.

The sense of smelling, which in beasts is so exquisite, and among birds is not wholly unknown, seems given to fishes in a very moderate proportion.⁴ It is true, that all fishes have one or more nostrils; and even those that have not the holes perceptible without, yet have the proper formation of the bones for smelling within. But as air is the only medium we know for the distribution of odours, it cannot be supposed that these animals, residing in water, can be possessed of any power of being affected by them. If they have any perception of smells, it must be in the same manner as we distinguish by our taste; and, it is probable, the olfactory membrane in fish serves them instead of a distinguishing palate; and by this they judge of substances, that, first tincturing the waters with their vapours, are thus sent to the nostrils of the fish, and no doubt produce some kind of sensation. This most probably must be the use of that organ in those animals, as otherwise there would be the instruments of a sense provided for them, without any power in them of enjoyment.

As to tasting, they seem to make very little distinction; the palate of most fish is hard and bony, and consequently incapable of the powers of relishing different substances. This sense among quadrupeds, who possess it in some degree, arises from the soft pliancy of the organ, and the delicacy of the skin which covers the instruments of tasting; it may be considered, in them, as a more perfect and delicate kind of feeling: in the bony palate of fish, therefore, all powers of distinguishing are utterly taken away; and we have accordingly often seen these voracious animals swallow the fisherman's plummet instead of the bait.

Hearing in fishes is found still more imperfect, if found at all. Certain it is, that anatomists have not been able to discover, except in the whale kind, the smallest traces of an organ, either within or without the head of fishes. It is true, that in the centre of the brain of some fishes are found now and then some little bones, the number and situation of which are entirely accidental. These bones Mr. Klein has supposed to constitute the organ of hearing; but if we consider their entire dissimilitude to the bones that serve for hearing in other animals, we shall be of another opinion. The greatest number of fishes are deprived of these bones entirely: some

fish have them in small numbers, and others in abundance; yet neither testify any excellence or defect in hearing. Indeed, of what advantage would this sense be to animals that are incapable of making themselves heard? They have no voice to communicate to each other, and consequently have no need of an organ for hearing. Mr. Gouan, who kept some gold fishes in a vase, informs us, that whatever noise he made, he could neither disturb nor terrify them; he hallooed as loud as he could, putting a piece of paper between his mouth and the water, to prevent the vibrations from affecting the surface, and the fishes still seemed insensible: but when the paper was removed, and the sound had its full play upon the water, the fishes seemed instantly to feel the change, and shrunk to the bottom. From this we may learn, that fishes are as deaf as they are mute; and that when they seem to hear the call of a whistle or a bell at the edge of a pond, it is rather the vibrations of the sound that affect the water, by which they are excited, than any sounds that they hear.⁵

Seeing seems to be the sense fishes are possessed of in the greatest degree; and yet even this seems obscure, if we compare it to that of other animals. The eye, in almost all fish, is covered with the same transparent skin that covers the rest of the head; and which, probably, serves to defend it in the water, as they are without eyelids. The globe is more depressed anteriorly, and is furnished behind with a muscle, which serves to lengthen or flatten it, according to the necessities of the animal. The crystalline humour, which in quadrupeds is flat, and of the shape of a button-mould, in fishes is round as a pea; or sometimes oblong, like an egg. From all this it appears that fish are extremely near-sighted; and that even in the water they can see objects at a very small distance.

⁵ It was well ascertained by Dr. John Hunter that fishes possess the sense of hearing, and that water is an excellent medium for the conveyance of sound. Their organ of hearing is placed on the sides of the skull, or the cavity that contains the brain; but differing in this respect from that in quadrupeds and birds, it is entirely distinct and detached from the skull. In some fishes, as those of the ray kind, the organ of hearing is wholly surrounded by the parts containing the cavity of the skull; in others, as the salmon and cod, it is in part within the skull. In structure it is by no means so complicated as in the quadrupeds and other animals who live in the air. Some genera, as the rays, have the external orifice very small, and placed on the upper surface of the head: but in others there is no external opening whatever. The following verses, by the Bishop of Dunkeld, furnish a curious specimen of reasoning in opposition to this undoubted fact:—

"Violent din the air brekis and dears,
Sine great motion of the water steirs,—
The water steirit, fishes for feariness flies,
But out of doubt no fish in water hears,
For, as we see, right few of them have ears;
And eke, forsooth, but if wise clerkis lies,
There is no air in with waters nor seas,
But whilk no thing might hear, as wise men lears,
Like as but light there is nothing that sees."

Gavin Douglas, *Pulce of Honour*, l. 28.—Ed.

⁴ There is now no doubt but that fishes possess the sense of smelling. Indeed, it seems to be mostly by their smell that they discover their food.—Ed.

This distance might very easily be ascertained, by comparing the refraction of bodies in the water with that formed by a lens that is spherical. Those unskilled in mathematical calculations will have a general idea of this, from the glasses used by near-sighted people. Those whose crystalline humour is too convex, or, in other words, too round, are always very near-sighted; and obliged to use concave glasses, to correct the imperfections of nature. The crystalline humour of fish is so round, that it is not in the power of any glasses, much less of water, to correct their vision. This crystalline humour in fishes all must have seen; being that little hard pea-like substance which is found in their eyes after boiling. In the natural state it is transparent, and not much harder than a jelly.

From all this it appears how far fish fall behind terrestrial animals in their sensations, and consequently in their enjoyments.⁶ Even their brain, which is by some supposed to be of a size with every animal's understanding, shows that

⁶ The following fine comparison is made by Baron Cuvier between fishes and birds. "The aerial being discovers with facility an immense horizon; its subtle ear appreciates every sound, every intonation, which it reproduces with its voice. If its beak is hard, if its body is covered with a kind of down, to preserve it from the intense cold of the high regions which it visits, it finds in its legs all the perfection of the most delicate touch. It enjoys all the sweets of conjugal and paternal love, and it fulfils all its duties with courage. The parents defend each other, and also their offspring,—a most surprising art presides in the construction of their habitations. When the season is come they work together and without remission; while the mother hatches the eggs with an extraordinary patience, the father, from an impetuous lover, becomes the most tender husband, and delights with his songs the melancholy of his mate. The bird even in confinement attaches itself to its master; it submits to him, and executes, by his order, the most neat and delicate actions; it hunts for him like the dog, and returns at his voice from the greatest height in the air; it imitates even his language, and it is with some degree of difficulty we are compelled to refuse it a kind of reason.—The inhabitant of the water does not attach itself. It has no language, no affection; it does not know what it is to be husband and father, or to make an abode for itself. In time of danger it hides itself under the rocks of the ocean, or rushes down into the depths of the sea; its life is monotonous; its voracity leads to its sole employment, and it is only thereby that we are able to direct its motions by certain signs from above. Yet these beings who possess so few enjoyments, have been adorned by nature with all kinds of beauty, variety in their forms, elegance in their proportions, diversity of colour: they have everything adapted to attract the attention of man, and it seems that it was this attention that nature was desirous to excite. Reflecting the lustre of every metal and precious stone, refracting the colours of the rainbow, in bands, in spots, in undulating, angular, but always regular and symmetrical lines, and always in shades admirably arranged and contrasted; for what purpose have they received these gifts—they who hardly see one another in depths where light can scarcely penetrate, and who, could they gaze on one another, can scarcely be supposed to feel any kind of pleasure by relations thus established?"—Ed.

fish are inferior even to birds in this particular. It is divided into three parts, surrounded with a whitish froth, and gives off nerves as well to the sense of sight as of smelling. In some fish it is gray, in others white; in some it is flatted, in others round; but in all extremely small, compared to the bulk of the animal.

Thus Nature seems to have fitted these animals with appetites and powers of an inferior kind; and formed them for a sort of passive existence in the obscure and heavy element to which they are consigned. To preserve their own existence, and to continue it to their posterity, fill up the whole circle of their pursuits and enjoyments; to these they are impelled rather by necessity than choice, and seem mechanically excited to every fruition. Their senses are incapable of making any distinctions; but they drive forward in pursuit of whatever they can swallow, conquer, or enjoy.

A ceaseless desire of food seems to give the ruling impulse to all their motions. This appetite impels them to encounter every danger; and indeed their rapacity seems insatiable. Even when taken out of the water, and almost expiring, they greedily swallow the very bait by which they were allured to destruction.

The maw is, in general, placed next the mouth, and though possessed of no sensible heat, is, however, endued with a surprising facility of digestion. Its digestive power seems, in some measure, to increase with the quantity of food it is supplied with; a single pike having been known to devour a hundred roaches in three days. Its faculties also are extraordinary; for it digests not only fish, but much harder substances; prawns, crabs, and lobsters, shells and all. These the cod or the sturgeon will not only devour, but dissolve down, though their shells are so much harder than the sides of the stomach which contains them. This amazing faculty in the cold maw of fishes has justly excited the curiosity of philosophers, and has effectually overturned the system of those who supposed that the heat of the stomach alone was a sufficient instrument for digestion. The truth seems to be, and some experiments of the skilful Dr. Hunter seem to evince, that there is a power of animal assimilation lodged in the stomach of all creatures, which we can neither describe nor define, converting the substances they swallow into a fluid fitted for their own peculiar support. This is done neither by trituration, nor by warmth, nor by motion, nor by a dissolving fluid, nor by their united efforts; but by some principle in the stomach yet unknown, which acts in a different manner from all kinds of artificial maceration. The meat taken into the stomach or maw is often seen, though very near being digested, still to retain its original form, and ready for a total dissolution, while it appears to the eye as yet untouched by the force of the stomach. This animal power is lodged in the maw of fishes, in a

greater degree than in any other creatures; their digestive powers are quick, and their appetites are ever craving.

Yet though fish are thus hungry, and for ever prowling, no animals can suffer the want of food for so long a time. The gold and silver fish we keep in vases seem never to want any nourishment at all: whether it be that they feed on the water-insects, too minute for our observation, or that water alone is a sufficient supply, is not evident; but they are often seen for months without apparent sustenance. Even the pike, the most voracious of fishes, will live in a pond where there is none but himself; and, what is more extraordinary, will be often found to thrive there.

Still, however, fishes are of all other animals the most voracious and insatiable. Whatever any of them is able to swallow, possessed of life, seems to be considered as the most desirable food. Some that have very small mouths feed upon worms and the spawn of other fish; others, whose mouths are larger, seek larger prey; it matters not of what kind, whether of another or their own. Those with the largest mouths pursue almost everything that has life; and often meet each other in fierce opposition, when the fish with the largest swallow comes off with the victory and devours its antagonist.

Thus are they irritated by the continual desire of satisfying their hunger; and the life of a fish, from the smallest to the greatest, is but one scene of hostility, violence, and evasion. But the smaller fry stand no chance in the unequal combat; and their usual way of escaping is by swimming into those shallows where the greater are unable or too heavy to pursue. There they become invaders in turn, and live upon the spawn of larger fish, which they find floating upon the surface of the water; yet there are dangers attending them in every place. Even in the shallows, the mussel, the oyster, and the scallop, lie in ambush at the bottom, with their shells open, and whatever little fish inadvertently approaches into contact, they at once close their shells upon him, and devour the imprisoned prey at their leisure.

Nor is the pursuit of fishes, like that of terrestrial animals, confined to a single region, or to one effort: shoals of one species follow those of another through vast tracts of ocean, from the vicinity of the pole even down to the equator. Thus the cod, from the banks of Newfoundland, pursues the whiting, which flies before it even to the southern shores of Spain. The cachelot is said, in the same manner, to pursue a shoal of herrings, and to swallow thousands at a gulp.

This may be one cause of the annual migration of fishes from one part of the ocean to the other; but there are other motives which come in aid of this also. Fishes may be induced to change the place of their residence, for one more suited to their constitutions, or more adapted to depos-

iting their spawn. It is remarkable that no fish are fond of very cold waters, and generally frequent those places where it is warmest. Thus, in summer, they are seen in great numbers in the shallows near the shore, where the sun has power to warm the water to the bottom; on the contrary, in winter, they are found towards the bottom in the deep sea; for the cold of the atmosphere is not sufficiently penetrating to reach them at those great depths. Cold produces the same effect upon fresh-water fishes; and when they are often seen dead after severe frosts, it is most probable that they have been killed by the severity of the cold, as well as by their being excluded by the ice from air.

All fish live in the water; yet all stand in need of air for their support. Those of the whale kind, indeed, breathe air in the same manner as we do, and come to the surface every two or three minutes to take a fresh inspiration; but those which continue entirely under water are yet under a necessity of being supplied with air, or they will expire in a very few minutes. We sometimes see all the fish of a pond killed, when the ice everywhere covers the surface of the water, and thus keeps off the air from the subjacent fluid.

If a hole be made in the ice, the fish will be seen to come all to that part, in order to take the benefit of a fresh supply. Should a carp in a large vase of water, be placed under an air-pump, and then be deprived of its air, during the operation a number of bubbles will be seen standing on the surface of the fish's body; soon after the animal will appear to breathe swifter, and with greater difficulty; it will then be seen to rise towards the surface, to get more air; the bubbles on its surface begin to disappear; the belly, that was before swollen, will then fall of a sudden; and the animal sinks expiring and convulsed at the bottom.

So very necessary is air to all animals, but particularly to fish, that, as was said, they can live but a few minutes without it; yet nothing is more difficult to be accounted for than the manner in which they obtain this necessary supply. Those who have seen a fish in the water must remember the motion of its lips and its gills, or at least of the bones on each side that cover them. This motion in the animal is, without doubt, analogous to our breathing; but it is not air, but water, that the fish actually sucks in and spouts out through the gills at every motion. The manner of its breathing is thus: the fish first takes in a quantity of water by the mouth, which is driven to the gills; these close and keep the water thus swallowed from returning by the mouth; while the bony covering of the gills prevents it from going through them, until the animal has drawn the proper quantity of air from the body of water thus imprisoned; then the bony-covers open, and give it a free passage; by which means also the gills again are opened, and admit a fresh quantity of water. Should the

fish be prevented from the free play of its gills, or should the bony-covers be kept from moving, by a string tied round them, the animal would soon fall into convulsions, and die in a few minutes.

But though this be the general method of explaining respiration in fishes, the difficulty remains to know what is done with this air, which the fish in this manner separates from the water. There seems to be no receptacle for containing it; the stomach being the chief cavity within the body, is too much filled with aliment for that purpose. There is indeed a cavity, and that a pretty large one, I mean the air-bladder or swim, which may serve to contain it for vital purposes; but that our philosophers have long destined to a very different use. The use universally assigned to the air-bladder, is the enabling the fish to rise or sink in the water at pleasure, as that is dilated or compressed. The use assigned by the ancients for it was to come in aid of the lungs, and to remain as a kind of store-house of air to supply the animal in its necessities. I own my attachment to this last opinion; but let us exhibit both with their proper share of evidence, and the reader must be left to determine.

The air-bladder is described as a bag filled with air, sometimes composed of one, sometimes of two, and sometimes of three divisions, situated towards the back of the fish, and opening into the maw or gullet. Those who contend that this bag is designed for raising or depressing the fish in the water, build upon the following experiment. A carp being put into the air-pump, and the air exhausted, the bladder is said to expand itself to such a degree, that the fish swells in an extraordinary manner, till the bladder bursts, and then the fish sinks, and ever after continues to crawl at the bottom. On another occasion, the air-bladder was pricked and wounded, which let out its air; upon which the fish sunk to the bottom, and was not seen to rise after. From thence it is inferred, that the use of the air-bladder must be by swelling, at the will of the animal, thus to increase the surface of the fish's body, and thence diminishing its specific gravity, to enable it to rise to the top of the water, and keep there at pleasure. On the contrary, when the fish wants to descend, it is, say they, but to exhaust this bladder of its air; and the fish being thus rendered slimmer and heavier, consequently sinks to the bottom.

Such is the account given of the use of the air-bladder; no part of which seems to me well supported. In the first place, though nothing is more certain than that a carp put into the air-pump will swell, yet so will a mouse or a frog; and these we know to have no air-bladders. A carp will rise to the surface; but so will all fish that want air, whether they have an air-bladder or not. The air-bladder is said to burst in the experiment; but that I deny. The air-bladder is indeed found empty, but it has suffered

no laceration, and may be distended by being blown into like any other bladder that is sound. The fish after the experiment, I grant, continues to creep at the bottom; and so will all fish that are sick and wounded, which must be the case with this after such an operation. Thus these facts prove nothing, but that when the fish is killed in an air-pump the air-bladder is found exhausted, and that it will naturally and necessarily be; for the drain of air by which the fish is supplied in the natural way will necessarily oblige it to make use of all its hidden stores; and, as there is a communication between the gullet and the air-bladder, the air which the latter contains will thus be obviously drawn away. But still farther, how comes the air-bladder, according to their hypothesis, to swell under the experiment of the air-pump? What is it that closes the aperture of that organ in such a manner as at last to burst it? or what necessity has the fish for dilating it to that violent degree? At most, it only wants to rise to the surface; and that the fish can easily do without so great a distention of the air-bladder. Indeed it should rather seem that the more the air was wanted without, the less necessity there was for its being uselessly accumulated within; and, to make the modern system consistent, the fish under the air-pump, instead of permitting its bladder to be burst, would readily give up its contents; which, upon their supposition, all can do at pleasure.

But the truth is, the fish can neither increase nor diminish the quantity of air in its air-bladder at will, no more than we can that which is contained in our stomachs. The animal has no one muscle, much less a pair of muscles, for contracting or dilating this organ; its aperture is from the gullet; and what air is put into it must remain there till the necessities, and not the will of the animal call it forth as a supply.

But, to put the matter past a doubt, many fish are furnished with an air-bladder, that continually crawl at the bottom; such as the eel and the flounder; and many more are entirely without any bladder, that swim at ease in every depth; such as the anchovy and fresh-water gudgeon.⁷ Indeed, the number of fish that want this organ is alone a sufficient proof that it is not so necessary for the purposes of swimming; and as the ventral fins, which in all fish lie flat upon the water, seem fully sufficient to keep them at all depths, I see no great occasion for this internal philosophical apparatus for raising and depressing them. Upon the whole, the air-bladder seems adapted for different purposes than that of keeping the fish at different depths in the water; but whether it be to supply them with air when it is wanted from without, or for what other purpose, I will not take upon me to determine.

Hitherto we have seen fish in every respect

⁷ Redi.

inferior to land animals; in the simplicity of their conformation, in their senses, and their enjoyments; but of that humble existence which they have been granted by nature, they have a longer term than any other class of animated nature. "Most of the disorders incident to mankind," says Bacon, "arise from the changes and alterations of the atmosphere; but fishes reside in an element little subject to change; theirs is a uniform existence; their movements are without effort, and their life without labour. Their bones also, which are united by cartilages, admit of indefinite extension; and the different sizes of animals of the same kind, among fishes, is very various. They still keep growing; their bodies, instead of suffering the rigidity of age, which is the cause of natural decay in land animals, still continue increasing with fresh supplies; and as the body grows, the conduits of life furnish their stores in greater abundance. How long a fish, that seems to have scarcely any bounds put to its growth, continues to live, is not ascertained; perhaps the life of a man would not be long enough to measure that of the smallest."

There have been two methods devised for determining the age of fishes which are more ingenious than certain; the one is by the circles of the scales, the other by the transverse section of the back-bone. The first method is this: When a fish's scale is examined through a microscope, it will be found to consist of a number of circles, one circle within another, in some measure resembling those which appear upon the transverse section of a tree, and supposed to offer the same information. For as in trees we can tell their age by the number of their circles, so in fishes we can tell theirs by the number of circles in every scale, reckoning one ring for every year of the animal's existence. By this method, Mr. Buffon found a carp, whose scales he examined, to be not less than a hundred years old; a thing almost incredible, had we not several accounts in other authors which tend to confirm the discovery. Gesner brings us an instance of one of the same age; and Albertus of one more than double that period.

The age of the skate and the ray, that want scales, may be known by the other method; which is, by separating the joints of the back-bone, and then minutely observing the number of rings, which the surface where it was joined exhibits. By this the fish's age is said to be known; and perhaps with as much certainty as in the former instance.

But how unsatisfactory soever these marks may be, we have no reason to doubt the great age of some fishes. Those that have ponds, often know the oldest by their superior size. But the longevity of these animals is nothing when compared to their fecundity. All sorts, a few of the larger ones excepted, multiply their kind, some by hundreds, and some by millions. There are

some that bring forth their young alive, and some that only produce eggs: the former are rather the least fruitful; yet even these are seen to produce in great abundance. The viviparous blenny, for instance, brings forth two or three hundred at a time, all alive, and playing round the parent together. Those who exclude their progeny in a more imperfect state, and produce eggs, which they are obliged to leave to chance, either on the bottom, at the edge of the water, or floating on the surface where it is deeper, are all much more prolific; and seem to proportion their stock to the danger there is of its consumption.⁸ Of these eggs thus deposited, scarcely one in a hundred brings forth an animal; they are devoured by all the lesser fry that frequent the shores; by aquatic birds near the margin; and by the larger fish in deep water. Still, however, there are enough for supplying the deep with inhabitants; and, notwithstanding their own rapacity, and that of the fowls of various tribes, the numbers that escape are sufficient to relieve the wants of a very considerable part of mankind.

⁸ In an early volume of the 'Edinburgh Philosophical Journal,' there is a slight notice of fishes' nests found on the coast of Berwickshire. The species of fish by which they are constructed is not mentioned; but Mr. Duncan of Eyemouth has ascertained that they belong to the Fifteen-spined stickleback (*Gasterosteus Spinachia* of Linnaeus). These nests are to be found in spring and summer on several parts of our coast, in rocky and weedy pools between tide-marks. They occur occasionally near Berwick, but seem to be more common near Eyemouth and Coldingham. They are about eight inches in length, and of an elliptical form, or pear-shaped, formed by matting together the branches of some common Fucus, as, for example, of the Fucus nodosus, with various confervæ, ulvæ, the smaller floridæ, and corallinos. These are all tied together in one confused compact mass by means of a thread run through and around, and amongst them, in every conceivable direction. The thread is of great length, as fine as ordinary silk, tough, and somewhat elastic; whitish, and formed of some albuminous secretion. The eggs are laid in the middle of this nest, in several irregular masses of about an inch in diameter, each consisting of many hundred ova, which are of the size of ordinary shot, and of a whitish or amber colour, according to their degree of maturity. The farther advanced are marked with two round black spots, which are discovered by the microscope to be the eyes of the embryo, at this period disproportionally large and developed. Masses of eggs, in different stages of their evolution, are met with in the same nest. It is evident that the fish must first deposit its spawn amid the growing fucus, and afterwards gather its branches together around the eggs, weaving and incorporating at the same time all the rubbish that is lying or floating around the nucleus. For the safety of its nest and spawn, the fish is apparently very anxious for a time. Some individuals were watched, by Mr. Duncan and the Rev. Mr. Turnbull, for some weeks, and it was observed that the same fish was always in attendance upon its own nest. During the time of hope and expectation, they become fearless, and will allow themselves to be taken up by the hand repeatedly. There can be no doubt that their object in remaining near the nest is to guard it against the attacks of such animals as might feel inclined to prey upon its contents.—ED.

Indeed, when we consider the numbers that a single fish is capable of producing, the amount will seem astonishing. If, for instance, we should be told of a being so very prolific, that in a single season it could bring forth as many of its kind as there are inhabitants in England, it would strike us with surprise; yet a single cod produces full that number. The cod spawns in one season, as Lewenhoeck assures us, above nine million of eggs or peas, contained in one single roe. The flounder is commonly known to produce above one million; and the mackerel above five hundred thousand. Such an amazing increase, if permitted to come to maturity, would overstock nature, and even the ocean itself would not be able to contain, much less to provide for, the half of its inhabitants. But two wise purposes are answered by this amazing increase; it preserves the species in the midst of numberless enemies, and serves to furnish the rest with a sustenance adapted to their nature.

Fishes seem, all except the whale kind, entirely divested of those parental solitudes which so strongly mark the manners of the more perfect terrestrial animals. How far they copulate remains as yet a doubt; for though they seem to join, yet the male is not furnished with any external instrument of generation. It is said, by some, that his only end in that action is to emit his impregnating milt upon the eggs that at that time fall from the female. He is said to be seen pursuing them as they float down the stream, and carefully impregnating them one after another. On some occasions also the females dig holes in the bottom of rivers and ponds, and there deposit their spawn, which is impregnated by the male in the same manner. All this, however, is very doubtful; what we know with certainty of the matter, and that not discovered till very lately, is, that the male has two organs of generation, that open into the bladder of urine, and that these organs do not open into the rectum as in birds, but have a particular aperture of their own.⁹ These organs of generation in the male are empty at some seasons of the year; but before the time of spawning they are turgid with what is called the milt, and emit the fluid proper for impregnation.

Fish have different seasons for depositing their spawn: some, that live in the depths of the ocean, are said to choose the winter months: but, in general, those with which we are acquainted, choose the hottest months in summer, and prefer such water as is somewhat tepidified by the beams of the sun. They then leave the deepest parts of the ocean, which are the coldest, and shoal round the coasts, or swim up the fresh-water rivers, which are warm as they are comparatively shallow. When they have deposited their burdens they then return to their old stations, and leave their nascent progeny to shift for themselves.

The spawn continues in its egg-state in some fish longer than in others, and this in proportion to the animal's size. In the salmon, for instance, the young animal continues in the egg from the beginning of December till the beginning of April; the carp continues in the egg not above three weeks; the little gold fish from China is produced still quicker. These all, when excluded, at first escape by their minuteness and agility. They rise, sink, and turn, much readier than grown fish; and they can escape into very shallow waters when pursued. But, with all their advantages, scarcely one in a thousand survives the numerous perils of its youth. The very male and female that have given them birth are equally dangerous and formidable with the rest, forgetting all relation at their departure.

Such is the general picture of these heedless and hungry creatures: but there are some in this class, living in the waters, that are possessed of finer organs and higher sensations; that have all the tenderness of birds or quadrupeds for their young, that nurse them with constant care, and protect them from every injury. Of this class are the *Cetaceous* tribe, or the fishes of the whale kind. There are others, though not capable of nursing their young, yet that bring them alive into the world, and defend them with courage and activity. These are the *Cartilaginous* kinds, or those who have gristles instead of bones. But the fierce unmindful tribe we have been describing, that leave their spawn without any protection, are called the *Spinous*, or bony kinds, from their bones resembling the sharpness of thorns.

Thus there are three grand divisions in the fish kind; the *cetaceous*, the *cartilaginous*, and the *spinous*: all differing from each other in their conformation, their appetites, in their bringing forth, and in the education of their young. These three great distinctions are not the capricious differences formed by a maker of systems, but are strongly and firmly marked in Nature. These are the distinctions of Aristotle; and they have been adopted by mankind ever since his time. It will be necessary, therefore, to give the history of each of these in particular; and then to arrange, under each head, those fishes whose history is the most remarkable; or, more properly speaking, those of which we have any history. For we shall find, when we come to any of the species in particular, how little can be said of their habits, their stations, or method of propagation.

Much, indeed, can be said of them if considered relatively to man; and large books have been written of the manner of taking fish, or of dressing them. Apicius is noted for first having taught mankind to suffocate fish in Carthaginian pickle; and Quin, for giving a sauce to the Johndory: Mrs. Glasse is famous for her eel-pie, and Mr. Tull for his invention of spaying carp, to give it a finer flavour. In this manner our cooks handle the subject. On the other hand, our physicians assure us that the flesh of fishes

⁹ Vide Gaman de Generatione Piscium.

yields little nourishment, and soon corrupts; that it abounds in a gross sort of oil and water, and hath but few volatile particles, which render it less fit to be converted into the substance of our bodies. They are cold and moist, and must needs, say they, produce juices of the same kind, and consequently are improper to strengthen the body. In this diversity of opinion, it is the wisest way to eat our fish in the ordinary manner, and pay no great attention to cooks or doctors.

I cannot conclude this chapter without putting a question to the learned, which I confess I am not able to resolve. How comes it that fish, which are bred in a salt element, have yet no salt to the taste, or that is capable of being extracted from them?¹⁰

CHAP. II.

OF CETACEOUS FISHES IN GENERAL.

As on land there are some orders of animals that seem formed to command the rest, with greater powers and more various instincts, so in the ocean there are fishes which seem formed upon a nobler plan than others, and that, to their fishy form, join the appetites and the conformation of quadrupeds. These are all of the *cetaceous* kind; and so much raised above their fellows of the deep, in their appetites and instincts, that almost all our modern naturalists have fairly excluded them from the finny tribes, and will have them called, not fishes, but *great beasts of the ocean*. With them it would be as improper to say men go to Greenland fishing for whale, as it would be to say that a sportsman goes to Blackwall a-fowling for mackerel.

Yet, notwithstanding philosophers, mankind will always have their own way of talking; and, for my own part, I think them here in the right. A different formation of the lungs, stomach, and intestines; a different manner of breathing or propagating; are not sufficient to counterbalance the great obvious analogy which these animals bear to the whole finny tribe. They are shaped as other fishes; they swim with fins; they are

¹⁰ Though fishes live in a salt element they do not subsist on it. All the water they take into their mouths is again discharged through the gills, after retaining the air contained in it for the purposes of life. The medium of water answers the precise purpose to fishes, that the medium of air does to man and other land animals. In inspiration, the element is received into the lungs or gills, and in expiration is returned deprived of its purer parts, which are retained for the purpose of animal economy. And whatever salt may be taken into the stomachs of fishes with their food, is decomposed and separated into its component parts of acid and soda. The sailor that feeds for twelve months together on salted meats, has not his own flesh made salt; but a decomposition taking place during the process of digestion, he becomes corrupted and scorbutic by the excess of soda and magnesia.—ED.

entirely naked, without hair; they live in the water, though they come up to breathe; they are only seen in the depths of the ocean, and never come upon shore but when forced thither. These, sure, are sufficient to plead in favour of the general denomination, and acquit mankind of error in ranking them with their lower companions of the deep.

But still they are as many degrees raised above other fishes in their nature, as they are in general in their size. This tribe is composed of the Whale and its varieties, of the Cachalot, the Dolphin, the Grampus, and the Porpoise. All these resemble quadrupeds in their internal structure, and in some of their appetites and affections. Like quadrupeds, they have lungs, a midriff, a stomach, intestines, liver, spleen, bladder, and parts of generation; their heart also resembles that of quadrupeds, with its partitions closed up as in them, and driving red and warm blood in circulation through the body. In short, every internal part bears a most striking similitude; and to keep these parts warm, the whole kind are also covered, between the skin and the muscles, with a thick coat of fat or blubber, which, like the bacon fat of a hog, keeps out the cold, renders their muscles glib and pliant, and probably makes them lighter in swimming.

As these animals breathe the air, it is obvious that they cannot bear to be any long time under water. They are constrained, therefore, every two or three minutes, to come up to the surface to take breath, as well as to spout out through their nostril (for they have but one) that water which they sucked in while gaping for their prey. This conduit by which they breathe, and also throw out the water, is placed in the head, a little before the brain. Though externally the hole is but single, it is internally divided by a bony partition, which is closed by a sphincter muscle on the inside, that, like the mouth of a purse, shuts it up at the pleasure of the animal. There is also another muscle or valve, which prevents the water from going down the gullet. When, therefore, the animal takes in a certain quantity of water, which is necessary to be discharged and separated from its food, it shuts the mouth, closes the valve of the stomach, opens the sphincter that kept the nostril closed, and then breathing strongly from the lungs, pushes the water out by the effort, as we see it rise by the pressure of air in a fire-engine.

The senses of these animals seem also superior to those of other fishes. The eyes of other fishes, we have observed, are covered only with that transparent skin that covers the rest of the head; but in all the cetaceous kinds, it is covered by eyelids, as in man. This, no doubt, keeps that organ in a more perfect state, by giving it intervals of relaxation, in which all vision is suspended. The other fishes, that are for ever staring, must see, if for no other reason, more feebly, as their organs of sight are always exerted.

As for hearing, these also are furnished with the internal instruments of the ear, although the external orifice nowhere appears. It is most probable that this orifice may open by some canal, resembling the Eustachian tube, into the mouth; but this has not as yet been discovered.

Yet Nature sure has not thus formed a complete apparatus for hearing, and denied the animal the use of it when formed. It is most likely that all animals of the cetaceous kind can hear, as they certainly utter sounds, and bellow to each other. This vocal power would be as needless to animals naturally deaf, as glasses to a man that was blind.

But it is in the circumstances in which they continue their kind, that these animals show an eminent superiority. Other fish deposit their spawn, and leave the success to accident; these never produce above one young, or two at the most; and this the female suckles entirely in the manner of quadrupeds, her breasts being placed, as in the human kind, above the navel. We have read many fabulous accounts of the nursing of the demigods of antiquity, of their feeding on the marrow of lions, and their being suckled by wolves; one might imagine a still more heroic system of nutrition, if we supposed that the young hero was suckled and grew strong upon the breast-milk of a she-whale!

The whale or the grampus are terrible at any time; but are fierce and desperate in the defence of their young. In Waller's beautiful poem of the Summer Islands, we have a story, founded upon fact, which shows the maternal tenderness of these animals for their offspring. A whale and her cub had got into an arm of the sea, where, by the desertion of the tide, they were enclosed on every side. The people from shore soon saw their situation, and drove down upon them in boats, with such weapons as the urgent occasion offered. The two animals were soon wounded in several places, and the whole sea round was tinged with their blood. The whales made several attempts to escape; and at last the old one, by its superior strength, forced over the shallow into the depths of the ocean. But though in safety herself, she could not bear the danger that awaited her young one; she therefore rushed in once more where the smaller animal was imprisoned, and resolved, when she could not protect, at least to share its danger.—The story ends with poetical justice; for the tide coming in, brought off both in safety from their enemies, though not without sustaining an infinite number of wounds in every part.

As to the rest, the distinctive marks of this tribe are, that the number of their fins never exceeds three; namely, two pectoral fins, and one back fin; but in some sorts the last is wanting. These fins differ very much from those of other fishes, which are formed of straight spines: the fins of the cetaceous tribe are made up of bones and muscles; and the skeleton of one of their fins very much resembles the skeleton of a

man's hand. Their tails also are different from those of all other fish: they are placed so as to lie flat on the surface of the water; while the other kinds have them, as we every day see, upright or edgeways. This flat position of the tail in cetaceous animals, enables them to force themselves suddenly to the surface of the water to breathe, which they are continually constrained to do.

Of these enormous animals some are without teeth, and properly called whales: others have the teeth only in the lower jaw, and are called, by the French, *cachalots*; the narwhal has teeth only in the upper jaw: the dolphin's teeth, as well as those of the porpoise and grampus, are both above and below. These are the marks that serve to distinguish the kinds of this enormous tribe from each other; and these shall serve to guide us in giving their history.

SUPPLEMENTARY NOTE.

The cetacea, of which the whale serves as an example, respire by means of lungs, incessantly by rising to the surface for atmospheric air: they are viviparous, and suckle their young; and the sexes associate in the manner of terrestrial animals. The bones, which represent those of the anterior limbs of quadrupeds, are concealed under thick tendinous envelops in the form of pectoral fins; those representing the hind limbs are displaced by the cartilages of a horizontal tail fin—in which respect they differ from fishes, for in them it is always vertical—and the pelvis is in a rudimentary state.

With gills pulmonic breathes the enormous whale,
And spouts aquatic columns to the gale;
Sports on the shining wave at noontide hours,
And shifting rainbows crest the rising showers.—DARWIN.

Some striking peculiarities present themselves in the general organization of the cetacea. Constantly immersed in the water, with the exception of a small portion of the body, it became necessary to the act of respiration, that the nostrils should have a direction differing from terrestrial mammalia; and we find in the cetacea apertures which have been named *Spiracles*, placed on the summit of the head, in a perpendicular direction, by which are performed the functions of respiration, and the ejection of the water which passes into the mouth during the act of feeding.

The enormous size of the cetacea is perhaps one of the most amazing facts in their history; varying in development from the most colossal proportions to the ordinary size of other beings, they are in their extreme bulk the largest of known animals. Indeed it is natural, says Lesson, that these giants of the animal kingdom, occupying the immense deserts of the sea, should bear relation to the vast surface which they have to animate. Thus the extensive wastes of Africa are the habitations of the largest quadrupeds, such as the elephant, the rhinoceros, and the giraffe.

The habits of the cetacea vary in the different groups. The whales are large and harmless, but move in their native element with amazing power; the *cachalots* are fierce and courageous; the dolphins warlike and voracious. The development of the brain bears an interesting relation to the manners of the animal; of little magnitude in any of the cetacea, in proportion to the bulk of the body, it assumes its maximum in dolphins, and their possession of superior intelligence is attested by all who have studied their habits.

Till the time of Bloch, whales and their congeners were always associated with fishes, and it was not till the first edition of the Animal Kingdom by Cuvier, that a true arrangement of cetaceous animals was formed. These he divided into the *herbivorous cetacea*, and the *cetacea proper*, which feed on fish. The whole animals forming the class, however, are remarkable for the strong typical similarity that exists amongst the different species of which it is composed.

CHAP. III.

OF THE WHALE PROPERLY SO CALLED, AND ITS VARIETIES.

If we compare land-animals, in respect to magnitude, with those of the deep, they will appear contemptible in the competition. It is probable indeed, that quadrupeds once existed much larger than we find them at present. From the skeletons of some that have been dug up at different times, it is evident that there must have been terrestrial animals twice as large as the elephant; but creatures of such an immense bulk required a proportionable extent of ground for subsistence, and, by being rivals with men for large territory, they must have been destroyed in the contest.

But it is not only upon land that man has exerted his power of destroying the larger tribes of animated nature, he has extended his efforts even into the midst of the ocean, and has cut off numbers of those enormous animals, that had perhaps existed for ages. We now no longer hear of whales two hundred, and two hundred and fifty feet long, which we are certain were often seen about two centuries ago. They have all been destroyed by the skill of mankind, and the species is now dwindled into a race of diminutive animals, from thirty to about eighty feet long.

The northern seas were once the region to which the greatest of these animals resorted; but so great has been the slaughter of whales for more than two ages, that they begin to grow thinner every day; and those that are now found there, seem, from their size, not come to their full dimensions. The greatest whales resort to places where they have the least disturbance; to those seas that are on the opposite side of the globe, near the south pole. In that part of the world there are still to be seen whales that are above a hundred and sixty feet long; and perhaps even longer might be found in those latitudes near the south pole, to which we have not as yet ventured.¹

¹ It is now well-ascertained that all the whales which frequent the polar seas pass annually to the southward, in large bodies, in the months of March and April, about midway between the coasts of Ireland and Newfoundland. From a report of a committee of the house of commons on the public works of Ireland, we learn that whales appear in

Taking the whale, however, at the ordinary size of eighty feet long and twenty feet high, what an enormous animated mass must it appear to the spectator! With what amazement must it strike him, to behold so great a creature gambolling in the deep, with the ease and agility of the smallest animal, and making its way with incredible swiftness! This is a sight which is very common to those who frequent the northern or southern ocean. Yet though this be wonderful, perhaps still greater wonders are concealed in the deep, which we have not had opportunities of exploring. These large animals are obliged to show themselves in order to take breath; but who knows the size of those that are fitted to remain for ever under water, and that have been increasing in magnitude for centuries! To believe all that has been said of the Sea-serpent or the Kraken, would be credulity; to reject the possibility of their existence would be presumption.

The Whale is the largest animal of which we have any certain information; and the various purposes to which, when taken, its different parts are converted, have brought us tolerably acquainted with its history. Of the whale, properly so called, there are no less than seven different kinds; all distinguished from each other by their external figure, or internal conformation. The Great Greenland whale, without a back-fin, and black on the back; the Iceland whale, without a back-fin, and whitish on the back; the New-England whale, with a hump on the back; the whale with six humps on the back; the Fin-fish, with a fin on the back near the tail; the Pike-headed whale, and the Round-lipped whale. All these differ from each other in figure, as their names obviously imply. They differ also somewhat in the manner of their living; the fin-fish having a larger swallow than the rest, being more active, slender, and fierce, and living chiefly upon herrings. However, there are none of them very voracious; and, if compared to the cachalot, that enormous tyrant of the deep, they appear harmless and gentle. The history of the rest, therefore, may be comprised under that of the Great common Greenland whale, with which we are best acquainted.

The Great Greenland whale is the fish for taking which there are such preparations made in Europe. It is a large heavy animal, and the head alone makes a third of its bulk. It is usually found from sixty to seventy feet long. The

great numbers on the western coasts of that country in the spring months, and are totally neglected and unpursued, in consequence of the poverty and want of means of equipment of the people of that coast. This being the case, it is evident that the Polar seas have been too long and needlessly visited in search of cetaceous animals, at the expense of much loss of property, time, and human life; as whales may be equally well encountered and captured in the Atlantic ocean, as in the dangerous northern regions.—ED.

fins on each side are from five to eight feet, composed of bones and muscles, and sufficiently strong to give the great mass of body which they move, speed and activity. The tail, which lies flat on the water, is about twenty-four feet broad; and, when the fish lies on one side, its blows are tremendous. The skin is smooth and black, and in some places marbled with white and yellow; which, running over the surface, has a very beautiful effect. This marbling is particularly observable in the fins and the tail. In the figures which are thus drawn by nature, fancy often forms the pictures of trees, landscapes, and houses. In the tail of one that was thus marbled, Ray tells us, that the number 122 was figured very evenly and exact, as if done with a pencil.

The whale makes use only of the tail to advance itself forward in the water. This serves as a great oar to push its mass along; and it is surprising to see with what force and celerity its enormous bulk cuts through the ocean. The fins are only made use of for turning in the water, and giving a direction to the velocity impressed by the tail. The female also makes use of them when pursued, to bear off her young, clapping them on her back, and supporting them by the fins on each side from falling.

The outward or scarf skin of the whale is no thicker than parchment; but this removed, the real skin appears, of about an inch thick, and covering the fat or blubber that lies beneath; this is from eight to twelve inches in thickness; and is, when the fish is in health, of a beautiful yellow. The muscles lie beneath; and these, like the flesh of quadrupeds, are very red and tough.

The cleft of the mouth is above twenty feet long, which is near one-third of the animal's whole length; and the upper jaw is furnished with barbs, that lie like the pipes of an organ, the greatest in the middle, and the smallest to the sides. These compose the whalebone; the longest spars of which are found to be not less than eighteen feet; the shortest, being of no value, are thrown away. The tongue is almost immovably fixed to the lower jaw, seeming one great lump of fat; and, in fact, it fills several hogsheads with blubber. The eyes are not larger than those of an ox; and when the crystalline humour is dried, it does not appear larger than a pea. They are placed towards the back of the head, being the most convenient situation for enabling them to see both before and behind; as also to see over them, where their food is principally found. They are guarded by eye-lids and eye-lashes, as in quadrupeds; and they seem to be very sharp-sighted.

Nor is their sense of hearing in less perfection; for they are warned at great distances, of any danger preparing against them. It would seem as if nature had designedly given them these advantages, as they multiply little, in or-

der to continue their kind. It is true, indeed, that the external organ of hearing is not perceptible, for this might only embarrass them in their natural element; but as soon as the thin scarf-skin above-mentioned is removed, a black spot is discovered behind the eye, and under that is the auditory canal, that leads to a regular apparatus for hearing. In short, the animal hears the smallest sounds at very great distances, and at all times, except when it is spouting water; which is the time that the fishers approach to strike it.

These spout-holes, or nostrils, in all the cetaceous tribe, have been already described: in this whale there are two, one on each side the head before the eyes, and crooked, somewhat like the holes on the belly of a violin. From these holes this animal blows the water very fiercely, and with such a noise, that it roars like a hollow wind, and may be heard at three miles' distance. When wounded, it then blows more fiercely than ever, so that it sounds like the roaring of the sea in a great storm.

We have already observed, that the substance called whalebone is taken from the upper jaw of the animal, and is very different from the real bones of the whale.² The real bones are hard,

² The Greenland whale affords to us a sublime instance of contrivance, compensating its total want of teeth, in the hundreds of plates of whalebone, which cover the roof of its mouth; and which, by their growth, increasing in length and in breadth, often acquire twelve feet in length, and fifteen inches broad. There have, indeed, been some instances in which whalebone has attained fifteen feet in length; since those whales which afford whalebone of twelve feet, are themselves often more than sixty feet in length. The upper surface of the skull of a whale of this size, measured twenty feet eight inches long; and the creature itself weighed upwards of a hundred tons. The roots of the two sides of the arch of whalebone, in the mouth of this animal, nearly meet at the top of the roof whence they grow, at the anterior part of the mouth; but they gradually recede from each other, as they are continued backwards, till they approach the throat when they again approximate. This substance, called whalebone, which thus supplies the place of teeth, consists of a peculiar kind of horn. Its plates differ in their length and strength, in different parts of the mouth, but the outer row of plates are by far the strongest and longest, especially those which are mid-way between the throat and the snout. As the fibres of every plate are loose and separate at its inferior edge, forming a deep pendant fringe, by the gradual splitting away of its substance in proportion as it is used, the entire vaulted sides of the roof of the mouth, in fact, by these means, is deeply lined with a clothing of thick and coarse hair, whence the ancients gave to this species of whale the name of mysticetus. Beneath this vault of hair lies the enormous tongue of the whale, and exterior to it is the immensely high lower lip, which, when the jaws are closed, shuts up over all externally to the very origin of the whalebone above, so as to entirely to conceal it from view. By means also of this formation of the lip, and the circumstance of the upper jaw shutting into a cartilaginous groove at the extremity of the lower one, the most perfect valve is formed, which any pressure from without only tends to render more secure from

like those of great land animals, are very porous, and filled with marrow. Two great strong bones sustain the under lip, lying against each other in the shape of a half-moon: some of these are twenty feet long; they are seen in several gardens set up against each other, and are usually mistaken for the ribs of this animal.

Such is the general conformation and figure of this great inhabitant of the deep, the precise anatomy of which has not been yet ascertained. In those places where they are caught in greatest abundance, the sailors are not very curious as to the structure of the viscera; and few anatomists care to undertake a task where the operator, instead of separating with a lancet, must cut his way with an axe. It is as yet doubted, therefore, whether the whale, that in most points internally resembles a quadruped, may not have one great bowel fitted entirely for the reception of air, to supply it, when constrained to keep longer than usual at the bottom. The sailors universally affirm that it has; and philosophers have nothing but the analogy of its parts to oppose to their general assertions.

As these animals resemble quadrupeds in conformation, so they bear a strong resemblance in some of their appetites and manners. The female joins with the male, as is asserted, *more humano*, and once in two years feels the accesses of desire.

Their fidelity to each other exceeds whatever we are told of even the constancy of birds. Some fishers, as Anderson informs us, having struck one of two whales, a male and a female, that were in company together, the wounded fish made a long and terrible resistance: it struck down a boat with three men in it, with a single blow of the tail, by which all went to the bottom. The other still attended its companion, and lent it every assistance; till, at last, the fish that was struck sunk under the number of its wounds; while its faithful associate, disdaining to survive the loss, with great bellowing stretched itself upon the dead fish, and shared its fate.

The whale goes with young nine or ten months, and is then fatter than usual, particularly when

the ingress of the water. The fringe produced by the whalebone (as it is constantly and gradually extending itself in length, by the growth of the whalebone behind it, in proportion as it is worn away), is thus always in a proper state of adaptation to the marvellous economy of the creature; for the most curious part of this beautiful mechanism is the net or sieve which it thus forms; an instrument which has been granted to this largest of creatures, for the purpose of straining or separating its minute prey from the water necessarily taken into the mouth with it, in feeding. For, in this whale, the mouth is of such enormous proportions, as to receive at once even tons of water, and yet of such wonderful perfection is its filtering mechanism through these hair-like filaments, that it rarely allows the escape of the nourishing particles diffused therein, although they be no larger than pease; its food consisting chiefly of small medusæ, crustacea, and zoophytes.—ED.

near the time of bringing forth. It is said that the embryo, when first perceptible, is about seventeen inches long, and white; but the cub, when excluded, is black, and about ten feet long. She generally produces one young one, and never above two. When she suckles her young, she throws herself on one side on the surface of the sea, and the young one attaches itself to the teat. The breasts are two, generally hid within the belly; but she can produce them at pleasure, so as to stand forward a foot and a half, or two feet; and the teats are like those of a cow. In some, the breasts are white; in others speckled; in all, filled with a large quantity of milk, resembling that of land animals.

Nothing can exceed the tenderness of the female for her offspring; she carries it with her wherever she goes, and, when hardest pursued, keeps it supported between her fins. Even when wounded, she still clasps her young one; and when she plunges to avoid danger, takes it to the bottom; but rises sooner than usual, to give it breath again.³

³ The extreme fidelity of these wonderful animals towards each other, and their affection for their offspring, is almost incredible. So fondly attached are they to the society of their brethren, that many instances are recorded of their assuming a passive floating position, on the surface, after offering much resistance; as though disdaining to survive the loss of their companions. Thus, when the *Cyrus* had captured six, out of a herd of seven whales, and they were supported around the vessel on the water, the surviving one rose, and thrust its head amongst its dead brethren, and remained immoveable, close to the vessel, while it was killed. In general, the female is accompanied in her progress by her young one, though, on the contrary, she sometimes wanders very far from it; and yet, by some unknown impulse, highly calculated to excite our amazement, she has no difficulty in finding it, though perfectly silent, in the vast and trackless ocean, as often as she requires; and the same may be said of all the cetacea. But further, when her young one is hardest pursued and harpooned, she supports it under her fin, while she plunges with it for safety into unfathomable depths. A young whale, having been struck by a harpoon from a Hull vessel, being at the time at some distance from its mother, had run out some length of line, when the latter appeared in sight, and rapidly bent her course towards it. In vain did she use every usual means to induce it to leave this place of danger, while swimming by its side, as far as the line would allow, in circles around the boats, during the space of four hours; and within this time, on four separate occasions, the parent was observed, when on the surface, to throw one of her fins over the body of the young whale, and to endeavour to drag it away by all the force she possessed; she lastly, in this way set off with it in a straight direction, carrying away additional line, to the extent of seven hundred and twenty fathoms; but by that time, the young one became so much exhausted from loss of blood, that she necessarily abandoned it to its fate, and herself escaped, by pursuing her progress towards the ice, roaring and spouting with great vehemence; for when a whale is struck with a harpoon, or is enraged by the loss of its young, it ejects the water through its spiracles with great force, producing a stridulous kind of roaring, which may be heard at the distance of a mile.—ED.

The young ones continue at the breast for a year; during which time they are called by the sailors, *short-heads*. They are then extremely fat, and yield above fifty barrels of blubber. The mother, at the same time, is equally lean and emaciated. At the age of two years they are called *stunts*, as they do not thrive much immediately after quitting the breast; they then scarcely yield above twenty, or twenty-four, barrels of blubber: from that forward they are called *skull-fish*, and their age is wholly unknown.

Every species of whale propagates only with those of its own kind, and does not at all mingle with the rest; however, they are generally seen in shoals of different kinds together, and make their migrations in large companies, from one ocean to another. They are a gregarious animal, which implies their want of mutual defence against the invasions of smaller, but more powerful fishes. It seems astonishing, therefore, how a shoal of these enormous animals find subsistence together, when it would seem that the supplying even one with food would require greater plenty than the ocean could furnish. To increase our wonder, we not only see them herding together, but usually find them fatter than any other animals of whatsoever element. We likewise know that they cannot swallow large fishes, as their throat is so narrow, that an animal larger than a herring could not enter. How then do they subsist and grow so fat?—A small insect, which is seen floating in those seas, and which Linnæus terms the *Medusa*, is sufficient for this supply. These insects are black, and of the size of a small bean, and are sometimes seen floating in clusters on the surface of the water. They are of a round form, like snails in a box, but they have wings, which are so tender, that it is scarcely possible to touch them without breaking. These serve rather for swimming than flying; and the little animal is called by the Icelanders, the *Walfischoas*, which signifies the whale's provender. They have the taste of raw mussels, and have the smell of burnt sugar. These are the food of the whale, which it is seen to draw up in great numbers with its huge jaws, and to bruise between its barbs, which are always found with several of these sticking to them.⁴

This is the simple food of the great Greenland

⁴ The food of the whale is generally supposed to consist of different kinds of sepia, medusa, or the *clio limacina* of Linnæus; but there is great reason to suppose, that it is chiefly, if not altogether, of the squillæ or shrimp tribe; for in examining the stomach of one of a large size, nothing else was found in it: they were about half-an-inch long, semi-transparent, and of a pale-red colour. When the whale feeds, it swims with considerable velocity under water, with its mouth wide open; the water enters by the fore-part, but is poured out again at the sides, and the food is entangled and sifted, as it were, by the whale-bone, which does not allow any thing to escape.—Ed.

whale; it pursues no other animal, leads an inoffensive life in its element, and is harmless in proportion to its strength to do mischief. There seems to be an analogy between its manners and those of the elephant. They are both the strongest and the largest animals in their respective elements; neither offer injury, but are terrible when provoked to resentment. The fin-fish indeed, in some measure, differs from the great whale in this particular, as it subsists chiefly upon herrings, great shoals of which it is often seen driving before it. Yet even the swallow of this fish is not very large, if compared to the cachalot tribe; and its ravages are but sports in comparison. The stomach and intestines of all these animals, when opened, seldom have anything in them, except a soft unctuous substance of a brownish colour; and their excrements are of a shining red.

As the whale is an inoffensive animal, it is not to be wondered at that it has many enemies willing to take advantage of its disposition, and inaptitude for combat. There is a small animal, of the shell-fish kind, called the *Whale-louse*, that sticks to its body, as we see shells sticking to the foul bottom of a ship.⁵ This insinuates itself chiefly under the fins; and whatever efforts the great animal makes, it still keeps its hold, and lives upon the fat, which it is provided with instruments to arrive at.

The sword-fish, however, is the whale's most terrible enemy. "At the sight of this little animal," says Anderson, "the whale seems agitated in an extraordinary manner; leaping from the water as if with affright: wherever it appears, the whale perceives it at a distance, and flies from it in the opposite direction. I have been myself," continues he, "a spectator of their terrible encounter. The whale has no instrument of defence except the tail; with that it endeavours to strike the enemy; and a single blow taking place, would effectually destroy its adversary: but the sword-fish is as active as the other is strong, and easily avoids the stroke; then bounding into the air, it falls upon its great sub-jacent enemy, and endeavours not to pierce with its pointed beak, but to cut it with its toothed edges. The sea all about is seen dyed with blood, proceeding from the wounds of the whale; while the enormous animal vainly endeavours to reach its invader, and strikes with its tail against the surface of the water, making a report at each blow louder than the noise of a cannon."

There is still another and more powerful enemy, called by the fishermen of New-England, the *Killer*. This is itself a cetaceous animal, armed with strong and powerful teeth. A number of these are said to surround the whale, in the same manner as dogs get round a bull. Some attack it with their teeth behind, others attempt

⁵ This is the *Lepus diadema*, or crown-shaped acorn shell of Linnæus.—Ed.

it before, until at last the great animal is torn down, and its tongue is said to be the only part they devour when they have made it their prey. They are said to be of such great strength, that one of them alone was known to stop a dead whale that several boats were towing along, and drag it from among them to the bottom.

But of all the enemies of these enormous fishes, man is the greatest: he alone destroys more in a year than the rest in an age, and actually has thinned their numbers in that part of the world where they are chiefly sought. The great resort of these animals was found to be on the inhospitable shores of Spitzbergen; where the distance of the voyage, the coldness of the climate, the terrors of the icy sea, and, still more, their own formidable bulk, might have been expected to protect them from human injury. But all these were but slight barriers against man's arts, his courage, and his necessities. The European ships, soon after the improvement of navigation, found the way into those seas; and as early as the beginning of the fourteenth century, the Biscayneers were in possession of a very considerable trade to the coast of Greenland. The Dutch and the English followed them thither, and soon took that branch of commerce out of their hands. The English commenced the business about the beginning of the seventeenth century; and the town of Hull had the honour of first attempting that profitable branch of trade. But, at present, it seems upon the decline, as the quantity of fish is so greatly reduced, by the constant capture for such a vast length of time.⁶ It

⁶ "The capture of the whale, which gives employment to several thousands of our seamen, and has annually produced, on an average of the last twenty years, between eleven and twelve thousand tons of oil, and from five to six hundred tons of whalebone, has of late years greatly declined, owing to the increasing difficulties attending the fishery. Wearied by the incessant persecutions of man, the whale has lately abandoned all the accessible parts of the Spitzbergen sea, where it was by no means unusual to see sixty or seventy sail of British vessels engaged in its capture. On the east side of Baffin's bay, as far as the 72° of latitude, abundance of whales of a large size were to be found, some few years ago; but, like the fishery in the Spitzbergen sea, this also was deserted. The whales retired to the westward of the then considered impenetrable barrier of ice that occupies the middle of Baffin's bay. In 1818 that barrier was passed by the first expedition of discovery, sent by the government to those regions; where the haunts of the whale and the nursery for its young were laid open to the fisherman, whose daring enterprise and perseverance in following the track of the discoverers, were amply rewarded for the first few years by most abundant success; since the produce that in any one year has been brought to England from those newly-discovered portions of the Arctic seas, is more than sufficient to cover the whole expenses of all the expeditions of discovery that have been sent, during the last twenty years, to those regions: and yet people, not aware of this circumstance, are perpetually asking what benefit can result to this country from such undertakings!

The whale, however, still continues to retire from

is now said that the fishers, from a defect of whales, apply themselves to the seal-fishery; yet, as these animals are extremely timorous, they will soon be induced to quit those shores, where they meet such frequent disturbance and danger. The poor natives of Greenland themselves, who used to feed upon the whale, are diminishing, in proportion as their sustenance is removed; and it is probable that the revolution of a few years will see that extensive coast totally deserted by its inhabitants, as it is already nearly deserted by the whales.

The art of taking whales, like most others, is much improved by time, and differs in many respects from that practised by the Biscayneers, when they first frequented the icy sea. But as the description of their method is the least complicated, and consequently the easiest understood, it will be best suited to our purpose.

For this navigation, the Biscayneers, in favourable seasons, fitted out thirty ships, of two hundred and fifty tons each, with fifty choice men a-piece, and a few boys. These were stored with six months' provision; and each ship had its boats, which were to be serviceable when come to the place of duty. When arrived at the part where the whales are expected to pass to the southward, they always keep their sails set, and a sailor is placed at the mast-head, to give information when he spies a whale. As soon as he discovers one, the whole crew are instantly in employment: they fit out their boats and row away to where the whale was seen. The harpooner, who is to strike the fish, stands at the prow of the boat, with a harpoon or javelin in his hand, five or six feet long, pointed with steel like the barb of an arrow, of a triangular shape. As this person's place is that of the greatest dexterity, so also it is of the greatest danger: the whale sometimes overturns the boat with a blow of its tail, and sometimes drives against it with fury. In general, however, the animal seems to sleep on the surface of the water: while the boat is approaching, the harpooner stands aloft, and with his harpoon tied to a cord of several hundred fathom length, darts it into the animal, and then rows as fast as possible away. It is some time before the whale seems to feel the blow; the instrument has usually pierced no deeper than the fat, and that being insensible, the animal continues for a while motionless; but soon roused from its seeming lethargy, as the shaft continues to pierce deeper and deeper into the muscular flesh, it flies off with amazing rapidity. In the meantime, the harpoon sticks in its side, while the rope, which is coiled up in the boat, and runs upon a

the persecutions of man; and the numbers of its young which are usually destroyed without remorse by the avaricious but imprudent fishermen, must soon exhaust the fishery; and search must then be made far to the westward of Baffin's bay, and to the eastward of Spitzbergen, for their places of retreat."—*Sir John Ross*.—Ed.

swivel, lengthens as the whale recedes, but still shows the part of the deep to which it has retreated. The cord is coiled up with great care; for such is the rapidity with which it runs off, that if it was but the least checked, as it yields with the animal's retreat, it would infallibly overset the boat, and the crew would go to the bottom. It sometimes happens also, that the rapidity with which it runs over the swivel at the edge of the boat, heats it, and it would infallibly take fire, did not a man stand continually with a wet mop in his hand, to cool the swivel as the cord runs.⁷ The whale having dived to a considerable depth, remains at the bottom, sometimes for near half an hour, with the harpoon in its body, and then rises to take breath, expecting the danger over; but the instant it appears, they are all with their boats ready to receive it, and fling their harpoons into its body; the animal again dives and again rises, while they repeat their blows. The ship follows in full sail, like all the rest, never losing sight of the boats, and ready to lend them assistance; the whole ocean seems dyed in blood. Thus they renew their attacks, till the whale begins to be quite enfeebled and spent, when they plunge their longer spears into various parts of its body, and the enormous animal expires. When it is dead, to prevent it from sinking, they tie it with a strong iron chain to the side of the boat, and either cut it up in pieces, and carry it home in that manner, or extract the oil from the blubber on ship-board.⁸

Such is the manner in which these fish were taken in the beginning; but succeeding arts have improved the method, and the harpoon is now thrown by; a machine being used which inflicts a deeper wound, and strikes the animal with much greater certainty: there are better methods for extracting the oil, and proper machines for cutting the animal up, than were used in the early fisheries. But as an account of this belongs to the history of art, and not of nature, we must be contented with observing, that several parts of this animal, and all but the intestines and the bones, are turned to a very good account; not only the oil, but the greaves from which it is separated. The barbs also were an article of great profit: but have sunk in their price, since women no longer use them to swell out their petticoats with whalebone. The flesh of this animal is also a dainty to some nations, and even the French seamen are now and then found to dress and use it as their ordinary diet at sea. It is said, by the English and Dutch sailors, to be hard and ill-tasted; but the French assert the contrary; and the savages of Greenland, as well as those near the south pole, are fond of it to distraction. They eat the flesh, and drink the oil, which is a first-rate delicacy. The finding a

dead whale is an adventure considered among the fortunate circumstances of their wretched lives. They make their abode beside it; and seldom remove till they have left nothing but the bones.

Jacobson, whom we quoted before in the History of Birds, where he described his countrymen of the island of Feroe as living a part of the year upon salted gulls, tells us also, that they are very fond of salted whale's flesh. The fat of the head they season with bay salt, and then hang it up to dry in the chimney. He thinks it tastes as well as fat bacon; and the lean, which they boil, is, in his opinion, not inferior to beef. I fancy poor Jacobson would make but an indifferent taster at one of our city feasts!

SUPPLEMENTARY NOTE.—*The Whale Fisheries.*

We here extract from the 'Edinburgh Cabinet Library' an account of the Northern Whale Fishery. "The first object is to fit out a ship suited to the trade. While the fishery was carried on in bays, or on the exterior margin of icy fields, very slight fabrics were sufficient; but now that the vessels depart early in the season, and push into the very heart of the northern ices, they are liable every moment to the most severe shocks and concussions. The ship, therefore, must be constructed in such a manner as to possess a peculiar degree of strength. Its exposed parts are secured with double or even treble timbers, while it is *fortified*, as the expression is, externally with iron plates, and internally with stanchions and cross-bars, so disposed as to cause the pressure on any one part to bear upon and be supported by the whole fabric. Mr. Scoresby recommends the dimension of 350 tons as the most eligible. A ship of this size is sometimes filled; and the number of men required for its navigation, being also necessary for manning the boats employed in the fishery, could not be reduced even in a much smaller vessel. A larger tonnage than 350, being scarcely ever filled, involves the proprietor in useless extra expense. The Dutch are of opinion, that the vessels destined for this fishery should be 112 feet long, 29 broad, and 12 deep, carrying seven boats, and from 40 to 50 seamen. One of the most essential particulars is the crow's nest, a species of sentry-box made of canvass or light wood, pitched on the main-top-mast, or top-gallant-mast head. This is the post of honour, and also of severe cold, where the master often sits for hours in a temperature thirty or forty degrees below the freezing-point, and whence he can descry all the movements of the surrounding seas and ice, and give directions accordingly. He is provided with a telescope, a speaking-trumpet, and a rifle, with which he can sometimes strike a narwal, as it floats around the ship.

The whaling vessels usually take their departure in such time as to leave the Shetland Isles about the beginning of April; and before the end of the month arrive within the polar seas. It was long customary to spend a few weeks at what is called the Seal-fishers' Bight, extending along the coast of Greenland, ere they pushed into those more northern waters, where, amid fields and mountains of ice, the powerful and precious *mysticetus* is tossing; but in later times it has become usual to sail at once into that centre of danger and enterprise.

As soon as they have arrived in those seas which are the haunt of the whale, the crew must be every moment on the alert, keeping watch day and night. The seven boats are kept hanging by the sides of the

⁷ It is also customary to have a man stationed with an axe, ready to cut the rope asunder should it become entangled.—Ed.

⁸ See Supplementary Note.

ship, ready to be launched in a few minutes; and, where the state of the sea admits, one of them is usually manned and afloat. These boats are from 25 to 28 feet long, about 5½ feet broad, and constructed with a special view to lightness, buoyancy, and easy steerage. The captain or some principal officer, seated in the crow's nest, surveys the waters to a great distance, and the instant he sees the back of the huge animal, which they seek to attack, emerging from the waves, gives notice to the watch who are stationed on deck: part of whom leap into a boat, which is instantly lowered down, and followed by a second, if the fish be a large one. Each of the boats has a harpooner, and one or two subordinate officers, and is provided with an immense quantity of rope coiled together, and stowed in different quarters of it, the several parts being spliced together, so as to form a continued line, usually exceeding 4,000 feet in length. To the end is attached the harpoon, an instrument formed not to pierce and kill the animal, but, by entering and remaining fixed in the body, to prevent its escape. One of the boats is now rowed towards the whale in the deepest silence, cautiously avoiding to give an alarm, of which he is very susceptible. Sometimes a circuitous route is adopted, in order to attack him from behind. Having approached as near as is consistent with safety, the harpooner darts his instrument into the back of the monster. This is a critical moment; for when this mighty animal feels himself struck, he often throws himself into violent convulsive movements, vibrating in the air his tremendous tail, one lash of which is sufficient to dash a boat in pieces. More commonly, however, he plunges with rapid flight into the depths of the sea, or beneath the thickest fields and mountains of ice. While he is thus moving at the rate usually of eight or ten miles an hour, the utmost diligence must be used that the line to which the harpoon is attached may run off smoothly and readily along with him. Should it be entangled for a moment, the strength of the whale is such, that he would draw the boat and crew after him under the waves. The first boat ought to be quickly followed up by a second, to supply more line when the first is run out, which often takes place in eight or ten minutes. When the crew of a boat see the line in danger of being all run off, they hold up one, two, or three oars, to intimate their pressing need of supply. At the same time they turn the rope once or twice round a kind of post called the bollard, by which the motion of the line and the career of the animal are somewhat retarded. This, however, is a delicate operation, which brings the side of the boat down to the very edge of the water, and if the rope is drawn at all too tight, may sink it altogether. While the line is whirling round the bollard, the friction is so violent, that the harpooner is enveloped in smoke, and water must be constantly poured on to prevent it from catching fire. When, after all, no aid arrives, and the crew find that the line must run out, they have only one resource,—they cut it, losing thereby not only the whale, but the harpoon and all the ropes of the boat.

When the whale is first struck and plunges into the waves, the boat's crew elevate a flag as a signal to the watch on deck, who give the alarm to those asleep below, by stamping violently on the deck, and crying aloud—"A fall, a fall!" (Dutch, *val*, expressing the precipitate haste with which the sailors throw themselves into the boats). On this notice, they do not allow themselves time to dress, but rush out in their sleeping-shirts or drawers into an atmosphere, the temperature of which is often below zero, carrying along with them their clothing in a bundle, and trusting to make their toilette in the interval of manning and pushing off the boats. Such is the tumult at this moment, that young

mariners have been known to raise cries of fear, thinking the ship was going down.

The period during which a wounded whale remains under water is various, but is averaged by Mr. Scoresby at about half an hour. Then, pressed by the necessity of respiration, he appears above, often considerably distant from the spot where he was harpooned, and in a state of great exhaustion, which the same ingenious writer ascribes to the severe pressure that he has endured when placed beneath a column of water 700 or 800 fathoms deep. All the boats have meantime been spreading themselves in various directions, that one at least may be within a *start*, as it is called, or about 200 yards of the point of his rising, at which distance they can easily reach and pierce him with one or two more harpoons before he again descends, as he usually does for a few minutes. On his reappearance a general attack is made with lances, which are struck as deep as possible, to reach and penetrate the vital parts. Blood mixed with oil streams copiously from his wounds and from the blow-holes, dyeing the sea to a great distance, and sprinkling and sometimes drenching the boats and crews. The animal now becomes more and more exhausted; but at the approach of his dissolution, he often makes a convulsive and energetic struggle, rearing his tail high in the air, and whirling it with a noise which is heard at the distance of several miles. At length, quite overpowered and exhausted, he lays himself on his side or back, and expires. The flag is then taken down, and three loud huzzas raised from the surrounding boats. No time is lost in piercing the tail with two holes, through which ropes are passed, which being fastened to the boats, drag the fish to the vessel amid shouts of joy.

The following account of whale-fishing in the South seas is from 'Wakefield's Adventures in New Zealand':—

Three or four boats are quickly launched, and leave the ways at a racing-pace; the boats of the rival stations are seen gathering towards the same point; and the occasional spout of the whale, looking like a small column of smoke on the horizon, indicates the direction to be taken. A great deal of stratagem and generalship is now shown by the different headsmen in their manœuvres to be first "alongside." The whale may probably go for two or three miles in one direction, and then, after the various speed of the boats has placed them in a long file, tailing one after the other, suddenly reverse the position by appearing close to the last boat. The six and seven oared boats have greatly the advantage while the chase continues in a straight line, but the short, old-fashioned five, have the best of it if the fish makes many turns and doubles. It is very common for some of the boats to dog the motions of that of a rival party commanded by a headsmen of known experience; and thus two boats may sometimes be seen starting suddenly in a direction totally opposed to that taken by the others, and a race shortly begins between these two, the rest having no chance. The "old file" in one of these two has guessed from some circumstance in the tide, wind, or weather, or from some symptom noticed in the last spout, that the fish would alter its course a point or two; and another headsmen, who had been attentively watching his movements, at last declares that "George is off," and, with a fresh word of encouragement to his crew, follows swiftly in his wake.

The chase now becomes animating; this last manœuvre has cut off a considerable angle described by the whale; her course and that of the boats almost cross each other; and the crisis seems approaching. The headsmen urges his rowers to exertion by encouraging descriptions of the animal's appearance. "There she breaches!"* shouts he; "and there

* She leaps out of the water.

goes the calf!" "Give way, my lads; sharp and strong's the word!—there she spouts again!—give way in the lull!—make her spin through it! George an't two boats' length a-head of us. Hurrah! Now she feels it—pull while the squall lasts! Pull!—go along, my boys!" All this time he is helping the after oarsman by propelling his oar with the left hand while he steers with the right. This is technically called "backing up." Each oar bends in a curve; the foam flies from her bows as a tide-ripple is passed; and both boats gain perceptibly on the whale. "And there goes flukes!" continues the headsman, as the huge animal makes a bound half out of water, and shows its broad tail as it plunges again head first into the sea. "Send us alongside, my lads—now give way! hurrah, my bonnies—hearty and strong! hurrah! I'll wager a pint (there goes the calf again!); I'll wager she turns out eight tun if she makes a gallon—hurrah! hurrah! hurrah! hurrah! then—three or four strokes more, and she'll come up under our nose. Stand up, Bill!" The boat-steerer peaks his oar, places one leg in the round notch in the front of the boat, and poises the harpoon, with line attached, over his head.

A new hand, pulling one of the oars, begins to look frightened, and flags at his work, looking occasionally over his shoulder; a volley of oaths from the headsman accompanies a threat to "break every bone in his skin if he *funks* now;" and, beginning to fear the man more than the fish, he hardens his heart and pulls steadily on.

A momentary pause is occasioned by the disappearance of the whale, which at last rises close to the rival boat. Their boat-steerer, a young hand lately promoted, misses the whale with his harpoon, and is instantly knocked down by a water-keg flung full in his face by his enraged headsman, who spares no "bad French" in explaining his motives. Our original friend then manœuvres his boat steadily to the place where the whale will probably appear next. "Pull two, back three!" shouts he, following a sudden turn in the whale's wake; and, as she rises a few yards in front of the boat, he cries in rapid succession, "Look out!—all clear?—give it her!" and the harpoon flies true and straight into the black mass. This is called "making fast." "Peak your oars!" says the headsman; the line whistles over the bow; a turn is taken round the loggerhead to check the rapidity with which the line runs out, and the boat flies positively through the water, forming ridges of foam high above her sides. The men sit still with folded arms by their peaked oars, the boat-steerer with a small hatchet in his hand to cut the line should any entanglement occur; and the after oarsman occasionally pours water on the loggerhead, which smokes furiously. Now is shown the skill of the headsman in steering the boat at this tremendous speed, and in watching every motion of the frightened whale. Now he gives directions to "haul in," when the line slackens; now says, "veer away again," as the fish takes a new start; and ever and anon terrifies the new hand, who can't tell what is going to happen, into a sort of resignation. The others seem to think the "running" rather a relief from work than anything else; they positively look as if they would smoke their pipes, were it not against all rule.

"The whale rapidly takes the line—and the 200 fathoms in the boat are nearly exhausted by its sudden determination to try the depth of the water, technically called "sounding;" but another boat of the same party, which had "hove up," or peaked her oars, when the chase was resigned to the two, comes up in answer to a whiff hoisted by our boat, and fixes a new harpoon in the whale as she rises to take breath. She soon becomes exhausted with her efforts, runs less rapidly, and rises more frequently

to the surface; and the headsman at last foresees the lucky moment.

"Come aft!" he cries; and he and the boat-steerer change places. The boat ceases her progress as the whale stops to rest. "Down oars—give way!" are the orders given in sharp, clear tones; and the crew, at least the old hands, know that he is nerved for his work by the decision apparent in his voice, and the way in which he balances the sharp, bright, oval-pointed lance.

The whale seems to sleep on the surface; but she is slowly preparing for a move as the boat comes up.

He follows her every movement. "A steady pull! Row dry, boys!—lay on! Pull two, back three!—lay on! head of all! lay me alongside!" and as the whale slowly rolls one fin out of the water, the lance flies a good foot into the spot below where the "life" is said to be. The quick obedience to his instant order of "starn all—lay off!" saves the boat from annihilation, as the whale swings round its huge tail out of the water, and brings it down with a tremendous report. She then "breaches," or leaps, and plunges in every direction; the headsman continues to direct his crew and boat-steerer, while he poises a new lance, and keeps just out of the vortex formed by her evolutions; the assistant boat and a third one have come up, and, being all of one party, watch outside the splashing for the best chance. One goes in, and having fixed a lance, receives a blow which smashes the boat and two men's legs; the third boat picks up the men; our first man at last gets steered into the vortex, gives a well-aimed lance in the life, and retreats from the foam, which receives a roseate hue. The monster leaps out of the sea, flourishing her tail and fins, and strikes the water with a noise as loud as cannon. She wriggles, and plunges, and twists more furiously than ever, and splashes blood over the boat's crew, who still restrain their excitement, and remain collected in all that they do. She is now in her "flurry"—she is said to "spout thick blood," and is a sure prize. The boat, by great good management, escapes all accident, and the headsman chuckles as he cuts a notch on the logger-head, and gives the crew a "tot all round," promising the novice that he will have to treat the party to a gallon to-night, in order to pay his footing on killing his first fish.

If the tide is favourable, all the boats of the party assemble and tow the whale home; if unfavourable, she is anchored for the night; and the boats reach the ways at dusk. A drunken rejoicing lasts till the middle of the night; the headsman meet in the principal *ware* at supper, and spin long yarns about their old whaling feats, the speed of their new boats, the strength of their crews, and the likelihood of a good season; the doctor—generally the runaway surgeon of a whaling ship, who gets fed and clothed by all the neighbouring stations—attends to the broken limbs; and the little town gradually subsides into silence, now and then interrupted by the barking of a bulldog from one of the huts, or the gibbering of a night-bird (called the *titi porangi*) as it flies across the bay.

Thousands of hands are annually employed, and immense capital is embarked in the South sea whale fisheries by the Americans. Commander Wilkes says: "Our whaling fleet may be said at this very day to whiten the Pacific ocean with its canvass, and the proceeds of this fishery give comfort and happiness to many thousands of our citizens. The ramifications of the business extend to all branches of trade, are spread through the whole Union, and its direct or secondary influence would seem to recommend it to the especial protection and fostering care of the government." Now, one drawback upon the profits of whaling voyages, both in the Pacific and the Arctic regions, has hitherto been

the uncertainty of meeting with whales in sufficient numbers to recompense the adventure:—"By a large majority of persons," says Commander Wilkes, "it is believed that the whale fishery is a mere lottery, in which success is more owing to good luck than to good management. Those, however, who entertain such an opinion are in error. There is, perhaps, no employment on the ocean wherein a sound judgment is more necessary, and no business where success depends more upon the experience, enterprise, and industry of the commander, than in that of whaling." Commander Wilkes is of opinion that by an increased attention to the great currents of the ocean, upon which he made a variety of experiments during his expedition, the pursuit of whales might be rescued from the hap-hazard character it has hitherto borne. It is now well-known that molluscous animals are the food of the whale, and the shoals of gelatinous medusæ are swept along by those mighty oceanic streams, the limits and direction of which are proved to be ascertainable, and regulated, as all Nature's operations are, by uniform laws. Tracing out these streams, and commenting, as he dwells upon each, on their course, character, and causes, Commander Wilkes indicates the best cruising grounds and the most appropriate seasons for visiting them respectively. There is ample room in the vast spaces pointed out as the resort of whales for the largest fleets to operate without interfering with each other, and without any reasonable fear of exhausting the supply. A notion prevails in the United States with respect to the sperm whales similar to that which we have occasionally heard from the masters of ships engaged in the Greenland and Davis straits fisheries—namely, that the whales are diminishing in numbers. Commander Wilkes took pains to inquire into this alleged diminution, and thinks the opinion is not well-founded:—"They have indeed become wilder, or, as some of the whalers express it, 'more scary,' and in consequence not so easy to capture; but if we consider the numbers that continue yearly to be taken, there will, I think, be no reason to suppose that any great decrease has occurred. On an average, it requires 50 whales to fill a ship, and it would therefore, take about 5,000 whales annually to supply the quantity of oil that is imported [into the United States]. This would appear but a small proportionate number, if these animals were as prolific as our herds on shore, when it is considered that they have a feeding-ground of 20,000,000 square miles." Their whaling interests in both the Atlantic and Pacific oceans are of such paramount importance to the United States, from the great number of hands employed therein, both ashore and afloat, that one of the first objects assigned to this exploring expedition was to gain every information that might render whaling voyages more productive and less dangerous. Accordingly, we find throughout the recorded operations of Commander Wilkes' squadron the most sedulous care devoted to ascertain whatever might tend to the benefit of the American whaler:—"Our whaling fleet now counts 675 vessels, the greater part of which are ships of 400 tons' burden, amounting in all to 200,000 tons. The value of the whole fleet is estimated at not less than 25,000,000 dollars, yielding an annual return of 5,000,000 dollars, extracted from the ocean by hard toil, exposure, and danger. The estimated quantity of oil imported into the United States is about 400,000 barrels, nearly one-half of which is sperm oil. The number of those on shore to whom this branch of business gives employment will readily be admitted to be twice as great as that of the crews. When we add to this profitable occupation of so many people, the value of the domestic products consumed by them, and the benefit that is thus conferred upon both our agricultural and manufacturing inter-

ests, the importance of this branch of business will appear greatly enhanced."

CHAP. IV.

OF THE NARWHAL.

FROM whales that entirely want teeth, we come to such as have them in the upper jaw only; and in this class is found but one, the Narwhal, or Sea-unicorn. This fish is not so large as the whale, not being above sixty feet long. Its body is slenderer than that of the whale, and its fat not in so great abundance. But this great animal is sufficiently distinguished from all others of the deep by its tooth or teeth, which stand pointing directly forward from the upper jaw, and are from nine to fourteen feet long. In all the variety of weapons with which Nature has armed her various tribes, there is not one so large or so formidable as this. This terrible weapon is generally found single, and some are of opinion that the animal is furnished but with one by nature; but there is at present the skull of a narwhal at the Stadthouse at Amsterdam, with two teeth; which plainly proves that in some animals, at least, this instrument is double. It is even a doubt whether it may not be so in all; and that the narwhal's wanting a tooth is only an accident it has met with in the encounters it is obliged daily to be engaged in. Yet it must be owned, of those that are taken only with one tooth, there seems no socket, nor the remains of any other upon the opposite side of the jaw, but all is plain and even. However this be, the tooth, or, as some are pleased to call it, the horn of the narwhal, is the most terrible of all natural instruments of destruction. It is as straight as an arrow, about the thickness of the small of a man's leg, wreathed in the manner we sometimes see twisted bars of iron; it tapers to a sharp point; and is whiter, heavier, and harder than ivory. It is generally seen to spring from the left side of the head directly forward in a straight line with the body; and its root enters into the socket above a foot and a half. In a skull to be seen at Hamburg there are two teeth, which are each above seven feet long, and are eight inches in circumference. When the animal, possessed of these formidable weapons, is urged to employ them, it drives directly forward against the enemy with its teeth, that, like protended spears, pierce whatever stands before them.

The extreme length of these instruments has induced some to consider them rather as horns than teeth; but they in every respect resemble the tusks of the boar and the elephant. They grow, as in them, from sockets in the upper jaw; they have the solidity of the hardest bone, and far surpass ivory in all its qualities. The same error has led others to suppose, that as among

quadrupeds the female was often found without horns, so these instruments of defence were only to be found in the male: but this has been more than once refuted by actual experience; both sexes are found armed in this manner; the horn is sometimes found wreathed, and sometimes smooth; sometimes a little bent, and sometimes straight; but always strong, deeply fixed, and sharply pointed.

Yet, notwithstanding all these appointments for combat, these long and pointed tusks, amazing strength, and unmatchable celerity, the narwhal is one of the most harmless and peaceful inhabitants of the ocean. It is seen constantly and inoffensively sporting among the other great monsters of the deep, no way attempting to injure them, but pleased in their company. The Greenlanders call the narwhal the forerunner of the whale; for wherever it is seen, the whale is shortly after sure to follow. This may arise as well from the natural passion for society in these animals, as from both living upon the same food, which are the insects described in the preceding chapter. These powerful fishes make war upon no other living creature; and though furnished with instruments to spread general destruction, are as innocent and as peaceful as a drove of oxen. Nay, so regardless are they of their own weapons, and so utterly unmindful to keep them in repair for engagement, that they are constantly seen covered over with weeds, slough, and all the filth of the sea; they seem rather considered as an impediment than a defence.

The manners and appetites both of the narwhal and the great whale are entirely similar; they both alike want teeth for chewing, and are obliged to live upon insects; they both are peaceable and harmless, and always rather fly than seek the combat. The narwhal, however, has a much narrower gape than the great whale, and, therefore, does not want the use of barbs to keep in its food when once sucked into the mouth. It is also much swifter, and would never be taken by the fishermen but for those very tusks which at first appear to be its principal defence. These animals, as was said, being fond of living together, are always seen in herds of several at a time; and whenever they are attacked they crowd together in such a manner, that they are mutually embarrassed by their tusks. By these they are often locked together, and are prevented from sinking to the bottom. It seldom happens, therefore, but the fishermen make sure of one or two of the hindmost, which very well reward their trouble.¹

It is from the extraordinary circumstance of the teeth, therefore, that this fish demands a distinct history; and such has been the curiosity of mankind, and their desire to procure them, that

¹ The blubber of the narwhal produces very fine oil; but it is chiefly hunted for its tusk, which forms ivory of a quality superior to that of the elephant.—Ed.

a century ago they were considered as the greatest rarity in the world. At that time the art of catching whales was not known; and mankind saw few, except such as were stranded on the coasts by accident. The tooth of the narwhal, therefore, was ascribed to a very different animal from that which really bore it. Among other fossil substances, they were sometimes dug up; and the narwhal being utterly unknown, naturalists soon found a terrestrial owner. They were thought to be the horns of unicorns, an animal described by Pliny as resembling a horse, and with one straight horn darting forward from the middle of its forehead. These teeth were, therefore, considered as a strong testimony in favour of that historian's veracity, and were shown among the most precious remains of antiquity. Even for some time after the narwhal was known, the deceit was continued, as those who were possessed of a tooth sold it to great advantage. But at present they are too well known to deceive any, and are only shown for what they really are; their curiosity increasing in proportion to their weight and size.²

CHAP. V.

OF THE CACHALOT, AND ITS VARIETIES.

THE Cachalot, which has generally gone under the name of the spermaceti-whale, till Mr. Pennant very properly made the distinction, by borrowing its name from the French, has several teeth in the under jaw, but none in the upper. As there are no less than seven distinctions among whales, so also there are the same number of distinctions in the tribe we are describing. The cachalot with two fins and a black back; the cachalot with two fins and a whitish back; that with a spout in the neck; that with a spout in the snout; that with three fins and sharp-pointed teeth; that with three fins and sharp-edged teeth; and, lastly, the cachalot with three fins and flatted teeth.

This tribe is not of such enormous size as the whale, properly so called, not being above sixty feet long, and sixteen feet high. In consequence of their being more slender, they are much more active than the common whale; they remain a longer time at the bottom; and afford a smaller quantity of oil. As in the common whale the head was seen to make a third part of its bulk, so in this species the head is so large as to make one half of the whole. The tongue of this ani-

² A species is mentioned by Fabricius, as being found on the shores of Greenland, much smaller, of a black colour, with two obtuse teeth from the upper jaw, a little curved at the tips, very weak, and measuring not above an inch in length: it has likewise a small fin on the back, which is wanting in the common narwhal.—Ed.

mal is small, but the throat is very formidable; and with very great ease it could swallow an ox. In the stomach of the whale scarcely anything is to be found; but in that of the cachalot there are loads of fish of different kinds; some whole, some half-digested, some small, and others eight or nine feet long. The cachalot is, therefore, as destructive among lesser fishes, as the whale is harmless; and can at one gulp swallow a shoal of fishes down its enormous gullet.—Linnaeus tells us that this fish pursues and terrifies the dolphins and porpoises so much as often to drive them on shore.

But, how formidable soever this fish may be to its fellows of the deep, it is by far the most valuable, and the most sought after by man, as it contains two very precious drugs,—spermaceti and ambergris. The use of these, either for the purposes of luxury or medicine, is so universal, that the capture of this animal, that alone supplies them, turns out to very great advantage, particularly since the art has been found out of converting all the oil of this animal, as well as the brain, into that substance called spermaceti.

This substance, as it is naturally formed, is found in the head of the animal, and is no other than the brain. The outward skin of the head being taken off, a covering of fat offers about three inches thick; and under that, instead of a bony skull, the animal has only another thick skin that serves for a covering and defence of the brain. The first cavity or chamber of the brain is filled with that spermaceti which is supposed of the greatest purity and highest value. From this cavity there is generally drawn about seven barrels of the clearest spermaceti, that thrown upon water coagulates like cheese. Below this there is another chamber just over the gullet, which is about seven feet long; and this also contains the drug, but of less value. It is distributed in this cavity like honey in a hive, in small cells, separated from each other by a membrane like the inner skin of an egg. In proportion as the oily substance is drawn away from this part, it fills anew from every part of the body; and from this is generally obtained about nine barrels of oil. Besides this, the spinal-marrow, which is as thick as a man's thigh, and reaches all along the back-bone to the tail, where it is not thicker than one's finger, affords no inconsiderable quantity.

This substance, which is used in the composition of many medicines, rather to give them consistence than efficacy, was at first sold at a very high price, both from the many virtues ascribed to it, and the small quantity the cachalot was capable of supplying: at present, the price is greatly fallen; first, because its efficacy in medicine is found to be very small: and again, because the whole oil of the fish is easily convertible into spermaceti. This is performed by boiling it with a ley of potash, and hardening it in the manner of soap. Candles are now made of

it, which are substituted for wax, and sold much cheaper; so that we need not fear having our spermaceti adulterated in the manner some medical books caution us to beware of; for they carefully guard us against having our spermaceti adulterated with virgin wax.

As to the ambergris, which is sometimes found in this whale, it was long considered as a substance found floating on the surface of the sea; but time, that reveals the secrets of the mercenary, has discovered that it chiefly belongs to this animal. The name, which has been improperly given to the former substance, seems more justly to belong to this; for the ambergris is found in the place where the seminal vessels are usually situated in other animals. It is found in a bag of three or four feet long, in round lumps from one to twenty pounds weight, floating in a fluid rather thinner than oil, and of a yellowish colour. There are never seen more than four at a time in one of these bags; and that which weighed twenty pounds, and which was the largest ever seen, was found single. These balls of ambergris are not found in all fishes of this kind, but chiefly in the oldest and strongest. The uses of this medicine for the purposes of luxury, and as a perfume, are well known; though upon some subjects ignorance is preferable to information.

SUPPLEMENTARY NOTE.

The interior organization of the cachalots is somewhat different from that of the whales, and requires a nourishment more substantial than small fish and marine mollusca. These animals consequently attack and devour several of the larger kinds of fish, and occasionally even porpoises, dolphins, and young whales, which they are enabled to seize and tear to pieces by means of their teeth. They are not contented, like the whales, with merely exerting their strength in self-defence; but will themselves provoke a combat with the larger inhabitants of the deep, and will attack and destroy them with the utmost vigour and address. Their ferocity and their muscular powers are such, that all the species are considered by the fishermen as extremely dangerous, and one or two of them in particular they are very cautious to avoid. It is said that some of them, when they are attacked, will throw themselves on their back, and in that position will defend themselves with their mouth.

The upper jaw of the cachalot is broad, and entirely destitute of teeth, or with teeth so short, as to be nearly concealed in the gum. The under jaw is narrow, and provided with somewhat large, conical teeth, which fit into sockets in the upper jaw. The spiracles, or breathing holes of the head, have only a single opening. The bodies of these animals are entirely destitute of hair, and their skin is very smooth and soft.

The length of the blunt-headed cachalot, when full grown, is about seventy feet, and its girth about fifty. When viewed from above, it appears like an immense animated mass, truncated in front, so that the muzzle terminates in a somewhat squared, and almost perpendicular extremity. The head constitutes nearly one-third of the whole body; the mouth is situated at the upper part, so as to have somewhat the appearance of a lid or cover of an enormous box turned upside down. The eyes are placed above

the corners of the mouth; and are so minute as to be scarcely perceptible. The pectoral fins are each about three feet in length. On the posterior part of the back there is a longitudinal and callous protuberance, or spurious fin. The tail is very small and slender, each of the lobes being hollowed somewhat like the blade of a scythe. The skin is smooth, oily, and almost as soft to the touch as silk. Its usual colour is black.

The perfume called *ambergris* is a substance much of the same nature as amber, but differing from it by its particular consistence, which nearly approaches to that of bees' wax; sometimes it is granulated, and appears opaque, or of a dark gray. Experiments prove that it resembles amber in its nature. When analyzed, it is found to consist of phlegm, a volatile acid partly fluid, oil, and a little coaly matter. It dissolves more readily than amber in spirit of wine. It is most common in the Indian seas, on the eastern coast of Africa, Madagascar, &c., and it is found either floating on the sea, or cast on the sea-shore. In this substance, animal and vegetable remains are sometimes found, as, for instance, the parts of birds. The origin of *ambergris* is probably the same with that of amber. According to M. Aublet, in his '*Histoire de la Guiane*,' it is nothing more than the juice of a tree, hardened by evaporation; and if this be true, it is a substance which belongs properly to the vegetable kingdom. The tree which is said to produce it grows in Guiana. It is called *cuma*, but has not been examined by other botanists. When a branch is broken by high winds, a large quantity of the juice exudes; and if it chance to have time to dry, various masses (some of which have been so large as to weigh one thousand two hundred pounds, and more) are carried into the rivers by heavy rains, and through them into the sea; afterwards they are either thrown on the shore, or eaten by fish, chiefly by the spermaceti whale (*Physeter macrocephalus*). This fish swallows such large quantities of this gum resin, that it generally becomes sick, so that those employed in the catching of those whales always expect to find some *ambergris* in the bowels of the lean whales. Father Santes, who travelled to various places on the African coast, says, in his '*Æthiopia Orientalis*,' that some species of birds, of whales, and of fish, are fond of eating this substance; and the same assertion has been made by Bomare and various other authors. This accounts for the claws, beaks, bones, and feathers of birds, parts of vegetables, shells and bones of fish, and particularly for the beaks of the cuttle-fish which are sometimes found in the masses of this substance. M. Aublet brought specimens of this gum resin, which he collected on the spot, from the *cuma* tree at Guiana. It is of a whitish-brown colour, with a shade of yellow; while it melts and turns like wax in the fire. M. Pouelle examined very carefully this substance brought over by M. Aublet, and found that it produced exactly the same results as amber. These observations seem to place it beyond a doubt, that both *amber* and *ambergris* are vegetable products, and that naturalists were mistaken in supposing these substances to be of an animal nature, from having found them in the intestines of whales.

CHAP. VI.

OF THE DOLPHIN, THE GRAMPUS, AND THE PORPOISE, WITH THEIR VARIETIES.

ALL these fish have teeth both in the upper and under jaw, and are much less than the whale.

The Grampus, which is the largest, never exceeds twenty feet. It may also be distinguished by the flatness of its head, which resembles a boat turned upside down. The Porpoise resembles the grampus in most things except the snout, which is not above eight feet long; its snout also more resembles that of a hog. The Dolphin has a strong resemblance to the porpoise, except that its snout is longer, and more pointed. They have all fins on the back; they all have heads very large, like the rest of the whale-kind; and resemble each other in their appetites, their manners, and conformations; being equally voracious, active, and roving.¹

The great agility of these animals prevents their often being taken. They seldom remain a moment above water; sometimes, indeed, their too eager pursuits expose them to danger; and a shoal of herrings often allures them out of their depth. In such a case, the hungry animal continues to flounder in the shallows till knocked on the head, or till the returning tide seasonably comes to its relief. But all this tribe, and the dolphin in particular, are not less swift than destructive. No fish could escape them, but from the awkward position of the mouth, which is placed in a manner under the head; yet, even with these disadvantages, their depredations are so great, that they have been justly styled the plunderers of the deep.

What could induce the ancients to a predilection in favour of these animals, particularly the dolphin, it is not easy to account for. Historians and philosophers seem to have contended who should invent the greatest number of fables concerning them. The dolphin was celebrated in the earliest time for its fondness to the human race, and was distinguished by the epithets of the boy-loving and philanthropist. Scarcely an accident could happen at sea, but the dolphin offered himself to convey the unfortunate to shore. The musician flung into the sea by pirates, the boy taking an airing in the midst of the sea, and returning again in safety, were obliged to the dolphin for its services. It is not easy, I say, to assign a cause why the ancients should thus have invented so many fables in their favour. The figure of these animals is far from prejudicing us in their interest; their extreme rapacity tends still less to endear them; I know nothing that can reconcile them to man and excite his prejudices, except that when taken they sometimes have a plaintive moan, with which they continue to express their pain till they expire. This, at first, might have excited human pity; and that might have produced affection. At present, these fishes are regarded even by the vulgar in a very different light; their appearance is far from being esteemed a favourable omen by the seamen; and from their bound-

¹ The dolphin tribe of cetaceous fishes comprehends about 13 species, 11 with the dorsal fin, and the others without.—Ed.

ings, springs, and frolics in the water, experience has taught the mariners to prepare for a storm.

But it is not to one circumstance only that the ancients have confined their fabulous reports concerning these animals; as from their leaps out of their element, they assume a temporary curvature, which is by no means their natural figure in the water, the old painters and sculptors have universally drawn them wrong. A dolphin is scarcely ever exhibited by the ancients in a straight shape, but curved, in the position which they sometimes appear as when exerting their force; and the poets too have adopted the general error. Even Pliny, the best naturalist, has asserted, that they instantly die when taken out of the water; but Rondelet, on the contrary, assures us that he has seen a dolphin carried alive from Montpellier to Lyons.

The moderns have more just notions of these animals; and have got over the many fables, which every day's experience contradicts. Indeed their numbers are so great, and, though shy, they are so often taken, that such peculiarities, if they were possessed of any, would have been long since ascertained. They are found, the porpoise especially, in such vast numbers, in all parts of the sea that surrounds this kingdom, that they are sometimes noxious to seamen, when they sail in small vessels. In some places they almost darken the water as they rise to take breath, and particularly before bad weather, are much agitated, swimming against the wind, and tumbling about with unusual violence.

Whether these motions be the gambols of pleasure or the agitations of terror, is not well known. It is most probable that they dread those seasons of turbulence, when the lesser fishes shrink to the bottom, and their prey no longer offers in sufficient abundance. In times of fairer weather they are seen herding together, and pursuing shoals of various fish with great impetuosity. Their method of hunting their game, if it may be so called, is to follow in a pack, and thus give each other mutual assistance. At that season, when the mackerel, the herring, the salmon, and other fish of passage, begin to make their appearance, the cetaceous tribes are seen fierce in the pursuit; urging their prey from one creek or bay to another, deterring them from the shallows, driving them towards each other's ambush, and using a greater variety of arts than hounds are seen to exert in pursuing the hare. However, the porpoise not only seeks for prey near the surface, but often descends to the bottom in search of sand-eels, and sea-worms, which it roots out of the sand with its nose, in the manner hogs harrow up the fields for food. For this purpose, the nose projects a little, is shorter and stronger than that of the dolphin; and the neck is furnished with very strong muscles, which enable it the readier to turn up the sand.

But it sometimes happens, that the impetuosity, or the hunger, of these animals, in their

usual pursuits, urges them beyond the limits of safety. The fishermen, who extend their long nets for pilchards, on the coasts of Cornwall, have sometimes an unwelcome capture in one of these. — Their feeble nets, which are calculated only for taking smaller prey, suffer a universal laceration from the efforts of this strong animal to escape; and if it be not knocked on the head, before it has had time to flounder, the nets are destroyed, and the fishery interrupted. There is nothing, therefore, they so much dread, as the entangling a porpoise; and they do every thing to intimidate the animal from approaching.¹

Indeed, these creatures are so violent in the pursuit of their prey, that they sometimes follow a shoal of small fishes up a fresh-water river, from whence they find no small difficulty to return. We have often seen them taken in the Thames at London, both above the bridges and below them. It is curious enough to observe with what activity they avoid their pursuers, and what little time they require to fetch breath above the water. The manner of killing them is for four or five boats to spread over the part of the river in which they are seen, and with fire-arms to shoot at them the instant they rise above the water. The fish being thus for some time kept in agitation, requires to come to the surface at quicker intervals, and thus affords the marksmen more frequent opportunities.

When the porpoise is taken, it becomes no inconsiderable capture, as it yields a very large quantity of oil; and the lean of some, particularly if the animal be young, is said to be as well tasted as veal. The inhabitants of Norway prepare, from the eggs found in the body of this fish, a kind of cavier, which is said to be a very delicate sauce, or good when even eaten with bread. There is a fishery for porpoise along the western isles of Scotland during the summer season, when they abound on that shore; and this branch of industry turns to good advantage.

As for the rest, we are told, that these animals go with young ten months; that, like the whale, they seldom bring forth above one at a time, and that in the midst of summer: that they live to a considerable age; though some say not above twenty-five or thirty years; and they sleep with the snout above water. They seem to possess, in a degree proportioned to their bulk, the manners of whales; and the history of one species of cetaceous animals, will, in a great measure, serve for all the rest.

¹ During a scarcity of fish, porpoises are said to dive to the bottom, and root, like hogs, among the sand, for sand-eels and sea-worms. Hence in most languages they receive the name of sea-hogs. Porpoise has that signification in the Italian.—Ed.

SUPPLEMENTARY NOTE.

The body of the *dolphin* is oblong and roundish, and the snout narrow and sharp-pointed, with a broad transverse band, or projection of the skin, on its

upper part. It is a longer and more slender animal than the porpoise, measuring nine or ten feet in length, and about two in diameter. The body is black above and white below. The mouth is very wide, reaching almost to the breast, and is provided with forty teeth; twenty-one in the upper, and nineteen in the under jaw: when the mouth is shut the teeth lock into each other.

The dolphin swims in troops, and its motions in the water are performed with such wonderful rapidity, that the French sailors call it *la flèche de la mer*, or 'the sea arrow.' We are informed by Rondelet, that persons who tormented themselves to do what was considered impossible, were often proverbially compared to those who would hold a dolphin by the tail. St. Pierre, in his voyage to the Isle of France, assures us that he saw a dolphin swim with apparent ease, round the vessel in which he was sailing, though it was going at the rate of about six miles an hour. A shoal of dolphins followed the ships of Sir Richard Hawkins upwards of a thousand leagues. They were known to be the same from the wounds they occasionally received from the sailors. They are greedy of almost any kind of scraps that are thrown overboard, and consequently are often to be caught by means of large iron hooks, baited with pieces of fish and garbage. The progressive motion of the dolphin in the water has a striking resemblance to the undulating motion of a ship under sail; and it has been remarked, that when their regular course has not by any accident been changed, it is usual for them to swim against the wind.

The bounding and gamboling of dolphins has attracted the attention of writers and poets in all ages; and is described as being extremely beautiful:

"What pleasing wonders charm the sailors' sight,
When calms the dolphin to their sports invite!
As jovial swains in tuneful measure tread,
And leave their rounding pressures on the mead;
So they in circling dance, with wanton ease,
Pursue each other round the furrow'd seas,
With rapid force the curling streams divide,
Add to the waves, and drive the slow-paced tide."

The ancients believed that dolphins attended all cases of shipwreck, and transported the mariners in safety to the shore. Pirætes having made captive Arion the poet, at length determined on throwing him overboard, and it is said that he escaped in safety to the shore on the back of a dolphin:

"But past belief, a dolphin's arched back
Preserved Arion from his destined wrack;
Secure he sits, and with harmonious strains
Requites the bearer for his friendly pains."

In consequence of these and other imaginary qualities, this animal was consecrated to the gods, and much celebrated for its love of the human race, and was honoured with the title of the Sacred Fish. It is thus spoken of by the poet:

"Kind, gen'rous dolphins love the rocky shore,
Where broken waves with fruitless anger roar.
But though to sounding shores they curious come,
Yet dolphins count the boundless sea their home.
Nay, should these favourites forsake the main,
Neptune would grieve his melancholy reign.
The calmest, stillest seas, when left by them,
Would awful frown, and all unjoyous seem.
But when the darling frisks his wanton play,
The waters smile, and every wave looks gay."

It matters little, nor can it now be accounted for, why this animal had acquired so much celebrity; but this we know, it has formed a fine poetical allusion in all ages, and has afforded much scope to the painter, in allegorical and imaginary pieces, where Neptune and Venus with their attendant tribes have been introduced.

The colour of the *Beluga* is cream white. This colour depends on a white rete mucosum, in many places about half an inch thick, which is covered with a thin transparent cuticle. It is destitute of a

dorsal fin; the opening of its mouth is small, and with nine obtusely pointed teeth on each side in both jaws. This animal measures from twelve to eighteen feet; it is a native of high northern latitudes; it abounds in the seas near Disco Island in Greenland, and is not uncommon off Spitzbergen, in latitude 77°. Scoresby never observed it lower than Jan Mayen's Land, and seldom saw it among the ice, but it seemed to frequent places where the water was clearest and smoothest. Thirty or forty belugas are often observed in a herd together. They are very seldom pursued by the whale fishers, because they find it difficult to strike them, on account of the great rapidity of their motions, and besides to our adventurers they are of little value when killed. Sir Charles Giesecke says, that belugas come in herds to the coast of West Greenland every year, about the end of November, their arrival being hastened by the prevalence of storms from the South-west. It is, next to the seal, the most useful animal to the Greenlanders. The flesh is said to be somewhat similar to that of beef, though oily, and the skin is also eaten, either raw, dried, or boiled; that by this skin, we however presume, is probably meant the thick white substance analogous to a *rete mucosum*, above-mentioned. Crantz evidently uses the term in this sense, when he says, 'the white wrinkled skin is the thickness of a finger.' The belugas are said not to be shy, but may be seen often tumbling themselves round near the boats of the Greenlanders. They are, however, so rapid in their motions, that they have been described as darting along with the velocity of an arrow. These animals may occasionally stray to the southward in pursuit of fish, or be impelled far in that direction, by long continued easterly winds. When they happen to get entangled among the drift-ice, if the wind prevail in one direction for several days, a straggler may be led so far from his haunts, as to be unable to rejoin his party. An instance of this kind occurred in the Frith of Forth, in the spring of 1815: when a beluga was noticed to pass and repass the harbour of Alloa, for about three months; and although many attempts were made to kill it, they all proved abortive, until it had extended its excursions up the intricately winding river Forth, as far as Stirling, where it was killed. This specimen was in shape highly symmetrical, and at once suggested the idea of perfect adaptation to rapid progressive motion in the water. It resembled generally a double cone, one end of which was considerably shorter than the other. The head was small and lengthened, but over the forehead, as in the narwhal and porpoise, was a thick round cushion of flesh and fat. The body continued to swell as far as the pectoral fins; and from this point gradually diminished to the setting on of the tail or organ of motion. On the middle of the back, as in other whales, there was a longitudinal ridge, partly bony, partly soft; its extreme length was thirteen feet four inches. The ordinary length of a full-grown beluga is from eighteen to twenty feet.

The length of the *Grampus* is from twenty to twenty-five feet. In its general form and colour it much resembles the rest of its tribe; the snout is blunt and short, and the body and tail elongated. The back fin of this animal sometimes measures six feet in length. The grampus is a great enemy to different species of whales; they assemble in large herds, and assail the larger whales like as many bulldogs, and tear at them till they give vent to their sufferings by loud and frequent bellowings; nor do they quit their victims in many cases till they kill and devour them. It is said they also attack seals, which they surprise while asleep on the rocks, from which situation they dislodge them with their fins, and precipitate them into the water.

It is very seldom that the grampus can be taken

alive, from its vast agility. They seldom remain more than a moment above the surface of the water; and it is only when they impetuously pursue their prey to shallow waters that they are taken. When thus stranded they flounder about at a great rate, and are either killed when observed, or sometimes make their escape upon the reflux of the tide. But it not unfrequently happens that they thus run themselves ashore during full tide, in which case they must either be taken or die.

In one of the poems of Waller, a story (founded on fact) is recorded of the parental affection of these animals. A grampus and her cub had got into an arm of the sea, where, by the desertion of the tide, they were enclosed on every side. The men on shore saw their situation, and ran down upon them with such weapons as they could at the moment collect. The poor animals were soon wounded in several places, so that all the immediately surrounding water was stained with their blood. They made many efforts to escape; and the old one, by superior strength, forced itself over the shallow, into a deep of the ocean. But though in safety herself, she would not leave her young one in the hands of assassins. She therefore again rushed in; and seemed resolved since she could not prevent, at least to share the fate of her offspring. The story concludes with poetical justice; for the tide coming in conveyed them both off in triumph.

The general form of the *Porpoise* much resembles that of the *dolphin*; it is, however, somewhat less in size, and has a snout both much broader and shorter. It measures generally from six to seven feet in length; thick in the fore parts, and gradually tapering towards the tail. The colour is either bluish-black or a very dark brown above, and nearly white beneath.

Although this animal has the same natural affections for its young, and leads nearly the same kind of life as the *dolphin*, yet it is improperly held by mankind in a different kind of estimation. The *dolphin* has been consecrated to the gods, while the

porpoise has in almost all languages obtained the degrading name of *sea-hog*. This arises from the fame attached to the former by the vivid imaginings of the Grecian poets, while the latter has acquired its appellation from sailors and fishermen, as the ancients knew little, if any thing, about the *porpoise*.

Porpoises are seldom seen, except in troops of from six to thirty. Indeed, they sometimes congregate in much larger numbers. On one occasion we saw a vast flock of them, from the windows of our apartments in Holy Island castle, coast of Northumberland. There must have been many hundreds in this flock, as they occupied a line of not less than a mile in length: and took a southern direction, seemingly in eager pursuit of fish. The great size of the caudal fin of the *porpoise*, and the strong muscles of their tail, contribute to render them very active in the water; along the surface of which, like *dolphins*, they sometimes move with surprising rapidity. They frequently gambol about on the water with great vivacity; their appearance is believed by the seamen to prognosticate approaching storms; and, on that account, they are held by them in great detestation. During the most tempestuous weather they are able to surmount the waves, and to pass along the agitated surface of the ocean, fearless of danger and secure from injury. All kinds of fish constitute their prey, but especially such as congregate in large shoals, such as cod, herrings, haddock, and mackerel.

The *porpoise* was once considered as a sumptuous article of food, and is said to have been occasionally introduced at the tables of the old English nobility. It was eaten with a sauce composed of sugar, vinegar, and crumbs of fine bread. It is, however, now generally neglected, even by the sailors. In America, the skin of this animal is tanned and dressed with care. At first it is extremely tender, and nearly an inch thick, but is shaved down till it becomes somewhat transparent. It is made into waistcoats and breeches by the inhabitants, and is said also to make excellent covering for carriages.

BOOK II.

OF CARTILAGINOUS FISHES.

CHAP. I.

INTRODUCTORY.

WE have seen that fishes of the cetaceous kind bear a strong resemblance to quadrupeds in their conformation; those of the cartilaginous kinds are one remove separated from them; they form the shade that completes the imperceptible gradations of nature.

The first great distinction they exhibit is, in having cartilages or gristles instead of bones. The cetaceous tribes have their bones entirely resembling those of quadrupeds, thick, white, and filled with marrow; those of the spinous kind, on the contrary, have small slender bones, with points resembling thorns, and generally

solid throughout. Fishes of the cartilaginous kinds have their bones always soft and yielding; and age, that hardens the bones of other animals, rather contributes still more to soften theirs. The size of all fishes increases with age; but from the pliancy of the bones in this tribe, they seem to have no bounds placed to their dimensions; and it is supposed that they grow larger every day till they die.

They have other differences, more obviously discernible. We have observed, that the cetaceous tribes had lungs like quadrupeds, a heart with its partition in the same manner, and an apparatus for hearing; on the other hand, we mentioned that the spinous kinds had no organs of hearing, no lungs to breathe through, and no partition in the heart; but that their cold red

blood was circulated by the means of the impulse made upon their gills by the water. Cartilaginous fishes unite both these systems in their conformation: like the cetaceous tribes, they have organs of hearing, and lungs; like the spinous kinds, they have gills, and a heart without a partition. Thus possessed of a twofold power of breathing, sometimes by means of their lungs, sometimes by that of their gills, they seem to unite all the advantages of which their situation is capable, and drawing from both elements every aid to their necessities or their enjoyments.

This double capacity of breathing in these animals, is one of the most remarkable features in the history of Nature. The apertures by which they breathe, are somewhere placed about the head; either beneath, as in flat fish; on the sides, as in sharks; or on the top of the head, as in pipe-fish. To these apertures are the gills affixed, but without any bone to open and shut them, as in spinous fishes; from which, by this mark, they may be easily distinguished, though otherwise very much alike in appearance. From these are bending cylindrical ducts, that run to the lungs, and are supposed to convey the air, that gives the organs their proper play. The heart, however, has but one valve; so that their blood wants that double circulation which obtains in the cetaceous kinds; and the lungs seem to be rather as an internal assistant to the gills, than fitted for supplying the same offices as in quadrupeds, for they want the pulmonary vein and artery.

From this structure, however, the animal is enabled to live a longer time out of water than those whose gills are more simple. The cartilaginous shark, or ray, live some hours after they are taken; while the spinous herring or mackerel expire a few minutes after they are brought on shore. From hence this tribe seems possessed of powers that other fishes are wholly deprived of; they can remain continually under water, without ever taking breath; while they can venture their heads above the deep, and continue for hours out of their native element.

We observed, in a former chapter, that spinous fishes have not, or at least appear not to have, externally any instruments of generation. It is very different with those of the cartilaginous kind, for the male always has these instruments double. The fish of this tribe are not unfrequently seen to copulate; and their manner is belly to belly, such as may naturally be expected from animals whose parts of generation are placed forward. They in general choose colder seasons and situations than other fish for propagating their kind; and many of them bring forth in the midst of winter.

The same duplicity of character which marks their general conformation, obtains also with regard to their manner of bringing forth. Some bring forth their young alive; and some bring forth eggs, which are afterwards brought to maturity. In all, however, the manner of gesta-

tion is nearly the same; for upon dissection, it is ever found, that the young, while in the body, continue in the egg till a very little time before they are excluded: these eggs they may properly be said to hatch within their body; and as soon as their young quit the shell, they begin to quit the womb also. Unlike to quadrupeds, or the cetaceous tribes, that quit the egg state in a few days after their first conception, and continue in the womb several months after, these continue in the body of the female, in their egg state, for weeks together; and the eggs are found linked together by a membrane, from which, when the fetus gets free, it continues but a very short time till it delivers itself from its confinement in the womb. The eggs themselves consist of a white and a yolk, and have a substance instead of shell, that aptly may be compared to softened horn. These, as I observed, are sometimes hatched in the womb, as in the shark and ray kinds; and they are sometimes excluded, as in the sturgeon, before the animal comes to its time of disengaging. Thus we see that there seems very little difference between the viviparous and the oviparous kinds, in this class of fishes; the one hatch their eggs in the womb, and the young continue no long time there; the others exclude their eggs before hatching, and leave it to time and accident to bring their young to maturity.

Such are the peculiar marks of the cartilaginous class of fishes, of which there are many kinds. To give a distinct description of every fish is as little my intention, as perhaps it is the wish of the reader; but the peculiarities of each kind deserve notice, and the most striking of these it would be unpardonable to omit.

Cartilaginous fish may be divided first into those of the shark kind, with a body growing less towards the tail, a rough skin, with the mouth placed far beneath the end of the nose, five apertures on the sides of the neck for breathing, and the upper part of the tail longer than the lower. This class chiefly comprehends the Great White shark, the Balance-fish, the Hound-fish, the Monk-fish, the Dog-fish, the Basking-shark, the *Zygæna*, the Tope, the Cat-fish, the Blue-shark, the Sea-fox, the Smooth Hound-fish, and the Porbeagle. These are all of the same nature, and differ more in size than in figure or conformation.

The next division is that of flat-fish; and these their broad, flat, thin shape, is sufficiently capable of distinguishing from all others of this kind. They may be easily distinguished also from spinous flat-fish, by the holes through which they breathe, which are uncovered by a bone; and which, in this kind, are five on each side. In this tribe we may place the Torpedo, the Skate, the Sharp-nosed ray, the Rough ray, the Thorn-back, and the Fire-flare.

The third division is that of the slender snake-shaped kind; such as the Lamprey, the Pride, and the Pipe-fish.

The fourth division is that of the Sturgeon and its variety, the Isinglass-fish.

The last division may comprise fish of different figures and natures, that do not rank under the former divisions. These are the Sun-fish, the Tetradon, the Lump-fish, the Sea-snail, the Chimæra, and the Fishing-frog. Each of these has somewhat peculiar in its powers or its form, that deserves to be remarked. The description of the figures of these at least may compensate for our general ignorance of the rest of their history.

CHAP. II.

OF CARTILAGINOUS FISHES OF THE SHARK KIND.

Of all the inhabitants of the deep, those of the shark kind are the fiercest and the most voracious. The smallest of this tribe is not less dreaded by greater fish, than many that to appearance seem more powerful; nor do any of them seem fearful of attacking animals far above their size: but the Great White shark, which is the largest of the kind, joins to the most amazing rapidity, the strongest appetites for mischief: as he approaches nearly in size to the whale, he far surpasses him in strength and celerity, in the formidable arrangement of his teeth, and his insatiable desire of plunder.

The White shark is sometimes seen to rank even among whales for magnitude; and is found from twenty to thirty feet long. Some assert that they have seen them of four thousand pound weight; and we are told particularly of one, that had a human corpse in his belly. The head is large and somewhat flattened; the snout long, and the eyes large. The mouth is enormously wide, as is the throat, and capable of swallowing a man with great ease. But its furniture of teeth is still more terrible; of these there are six rows, extremely hard, sharp-pointed, and of a wedge-like figure. It is asserted that there are seventy-two in each jaw, which make a hundred and forty-four in the whole; yet others think that their number is uncertain; and that in proportion as the animal grows older, these terrible instruments of destruction are found to increase. With these the jaws, both above and below, appear planted all over; but the animal has a power of erecting or depressing them at pleasure. When the shark is at rest, they lie quite flat in his mouth; but when he prepares to seize his prey, he erects all this dreadful apparatus, by the help of a set of muscles that join them to the jaw; and the animal he seizes, dies, pierced with a hundred wounds, in a moment.

Nor is this fish less terrible to behold as to the rest of his form: his fins are larger in proportion; he is furnished with great goggle eyes, that he turns with ease on every side, so as to see his

prey behind him as well as before; and his whole aspect is marked with a character of malignity: his skin also is rough, hard, and prickly; being that substance which covers instrument cases, called shagreen.

As the shark is thus formidable in his appearance, so is he also dreadful from his courage and activity. No fish can swim so fast as he; none so constantly employed in swimming; he outstrips the swiftest ships, plays round them, darts out before them, returns, seems to gaze at the passengers, and all the while does not seem to exhibit the smallest symptom of an effort to proceed. Such amazing powers, with such great appetites for destruction, would quickly unpeople even the ocean, but providentially, the shark's upper jaw projects so far above the lower, that he is obliged to turn on one side, (not on his back, as is generally supposed,) to seize his prey. As this takes some small time to perform, the animal pursued seizes that opportunity to make its escape.

Still, however, the depredations he commits are frequent and formidable. The shark is the dread of sailors in all hot climates; where, like a greedy robber, he attends the ships, in expectation of what may drop overboard. A man who unfortunately falls into the sea at such a time, is sure to perish, without mercy. A sailor that was bathing in the Mediterranean, near Antibes, in the year 1744, while he was swimming about fifty yards from the ship, perceived a monstrous fish making towards him, and surveying him on every side, as fish are often seen to look round a bait. The poor man, struck with terror at its approach, cried out to his companions in the vessel to take him on board. They accordingly threw him a rope with the utmost expedition, and were drawing him up by the ship's side, when the shark darted after him from the deep, and snapped off his leg.

Mr. Pennant tells us, that the master of a Guinea-ship, finding a rage for suicide prevail among his slaves, from a notion the unhappy creatures had, that after death they should be restored again to their families, friends, and country; to convince them at least that some disgrace should attend them here, he ordered one of their dead bodies to be tied by the heels to a rope, and so let down into the sea; and, though it was drawn up again with great swiftness, yet in that short space, the sharks had bit off all but the feet. Whether this story is prior to an accident of the same kind, which happened at Belfast in Ireland, about twenty years ago, I will not take upon me to determine; but certain it is, there are some circumstances alike in both, though more terrible in that I am going to relate. A Guinea captain was, by stress of weather, driven into the harbour of Belfast, with a lading of very sickly slaves, who, in the manner above-mentioned, took every opportunity to throw themselves overboard when brought up upon the

deck, as usual, for the benefit of the fresh air. The captain perceiving, among others, a woman slave attempting to drown herself, pitched upon her as a proper example to the rest. As he supposed that they did not know the terrors attending death, he ordered the woman to be tied with a rope under the arm-pits, and so let her down into the water. When the poor creature was thus plunged in, and about half-way down, she was heard to give a terrible shriek, which at first was ascribed to her fears of drowning; but soon after, the water appearing red all round her, she was drawn up, and it was found that a shark, which had followed the ship, had bit her off from the middle.¹

Such is the frightful rapacity of this animal; nothing that has life is rejected. But it seems to have a peculiar enmity to man; when once it has tasted human flesh, it never desists from haunting those places where it expects the return of its prey. It is even asserted, that along the coasts of Africa, where these animals are found in great abundance, numbers of the negroes, who are obliged to frequent the waters, are seized and devoured by them every year. The people of these coasts are firmly of opinion, that the shark loves the black man's flesh in preference to the white, and that when men of different colours are in the water together, it always makes choice of the former.

However this be, men of all colours are equally afraid of this animal, and have contrived different methods to destroy him. In general, they derive their success from the shark's own rapacity. The usual method of our sailors to take him, is by baiting a great hook with a piece of beef or pork,

which is thrown out into the sea by a strong cord, strengthened near the hook with an iron chain. Without this precaution, the shark would quickly bite the cord in two, and thus set himself free. It is no unpleasant amusement to observe this voracious animal coming up to survey the bait, particularly when not pressed by hunger. He approaches it, examines it, swims round it, seems for a while to neglect it, perhaps apprehensive of the cord and chain: he quits it for a little; but his appetite pressing, he returns again; appears preparing to devour it, but quits it once more. When the sailors have sufficiently diverted themselves with his different evolutions, they then make a pretence, by drawing the rope, as if intending to take the bait away: it is then that the glutton's hunger excites him; he darts at the bait, and swallows it, hook and all. Sometimes, however, he does not so entirely gorge the whole, but that he once more gets free; yet even then, though wounded and bleeding with the hook, he will again pursue the bait until he is taken. When he finds the hook lodged in his maw, his utmost efforts are then excited, but in vain, to get free; he tries with his teeth to cut the chain; he pulls with all his force to break the line; he almost seems to turn his stomach inside out, to disgorge the hook; in this manner he continues his formidable though fruitless efforts; till, quite spent, he suffers his head to be drawn above water, and the sailors, confining his tail by a noose, in this manner draw him on ship-board, and despatch him. This is done by beating him on the head till he dies; yet even that is not effected without difficulty and danger; the enormous creature, terrible even in the agonies of death, still struggles with his destroyers; nor is there an animal in the world that is harder to be killed. Even when cut in pieces, the muscles still preserve their motion, and vibrate for some minutes after being separated from the body. Another method of taking them, is by striking a barbed instrument, called a fizgig, into his body, as he brushes along by the side of the ship. As soon as he is taken up, to prevent his flouncing, they cut off the tail with an axe, with the utmost expedition.

This is the manner in which Europeans destroy the shark; but some of the Negroes along the African coast take a bolder and more dangerous method to combat their terrible enemy. Armed with nothing more than a knife, the Negro plunges into the water, where he sees the shark watching for his prey, and boldly swims forward to meet him: though the great animal does not come to provoke the combat, he does not avoid it, and suffers the man to approach him; but just as he turns upon his side to seize the aggressor, the Negro watches the opportunity, plunges his knife into the fish's belly, and pursues his blows with such success, that he lays the ravenous tyrant dead at the bottom; he soon however returns, fixes the fish's head in a noose,

¹ A singular circumstance occurred in February 1814, at St. Vincent, in Jamaica. A gentleman, named Whitlow, sailing in a boat at night from the leeward port of Kingston, and sitting in the stern sheets, a large shark that had followed made at length a spring at his intended victim, knocked off his hat, but at the same time fell into the boat. The gentleman, with great presence of mind, immediately jumped up and secured the voracious monster with a cloak and some bandages. It measured twelve feet, and was of enormous weight.—A Calcutta paper contains the following extract of a letter from Kidger, dated June 8th, 1814. "A boat belonging to the Ingles came up here that morning for water, and anchored in about one and a half fathom: a poor fellow belonging to her, attempted to swim on shore; but, horrid to relate, scarcely had he plunged into the water, when he was attacked by two large voracious sharks, who stripped the flesh from his legs and thighs. We hastened to his relief, and dragged the unhappy man to the shore, when he instantly expired. I never before beheld such a spectacle."—We happen to know an old sailor in the suburbs of Glasgow, who lost one of his legs by the bite of a shark. He had been bathing (in what sea we forget) when suddenly he felt a numbness in his limb, and would have sunk but for the assistance of his comrades. On being lifted aboard, his limb was found to be gone, and so sudden and dexterous had the amputation been, that it was unaccompanied by any immediate pain, beyond the numbness adverted to.—ED.

and drags him to shore, where he makes a noble feast for the adjacent villages.²

Nor is man alone the only enemy this fish has to fear: the Remora, or Sucking-fish, is probably a still greater, and follows the shark everywhere. This fish has got a power of adhering to whatever it sticks against, in the same manner as a cupping-glass sticks to the human body. It is by

² In the South American pearl-fisheries, every diver defends himself against these animals, by carrying with him into the water a sharp knife, which he sticks into the belly of the fish if attacked by it; and it is said generally to retreat if it receives a wound from the diver. While the divers are employed at the bottom of the ocean, the officers of the vessels generally keep a sharp look-out for the approach of sharks, and when one is observed, the ropes attached to the negroes are shaken to put them on their guard. It sometimes occurs that those on deck plunge into the water at the approach of a shark, with knives in their hands to defend their comrades, which, however, is sometimes of no avail. Daily accustomed to see sharks, the natives of the South Sea islands are not afraid of them, and may be seen enjoying the luxury of bathing even while these frightful animals are within their reach. Captain Portlock says, "I have seen five or six large sharks swimming about the ship when there have been upwards of a hundred Indians in the water, both men and women; they seem quite indifferent respecting them, and the sharks never offered to make an attack on any of the men, and yet at the same time would seize our bait greedily; whence it is manifest that they derive their confidence of safety from their experience, that they are able to repel the attacks of those devouring monsters." It is singular that the shark will not prey upon birds: although they will take a bait of any kind of flesh thrown overboard to them.

It is related in the 'History of Barbadoes,' that in the reign of Queen Anne, an English vessel having arrived at that country, some of the men were one day bathing, when a large shark sprung among them. A person on board perceiving the approach of the shark gave the alarm, when they all immediately swam to the ship, into which they all ascended in safety, except one, which the shark got hold of and snapt his body in two. A comrade and attached friend of the unfortunate man, when he beheld the lifeless trunk of his friend, was roused by a sudden impulse of revenge; and while the shark was seen swimming about amongst the blood-stained water in search of the remainder of his prey, the resolute youth plunged into the water, determined that he should compel the shark to disgorge the half of his victim, or be himself buried in the same grave. He had supplied himself with a long and sharp-pointed knife, and the rapacious animal no sooner beheld him in the water, than it made a desperate plunge at him; but the youth dexterously avoided the bite of the shark by diving under him, and seizing him somewhere below the pectoral fins, stabbed him several times in the belly. During this desperate adventure, the shark writhing with pain, and streaming with blood, plunged in all directions in order to disengage himself from his enemy. The crews of the surrounding vessels saw that the fate of this desperate conflict was decided; but they were ignorant which of the two had been slain, until at length, the shark, weakened by loss of blood, made towards the shore, and the young man still held fast by him, and forcing the animal on the beach, ripping up his stomach, obtained the half of his friend, and buried it and the trunk in the same grave.—Ed.

such an apparatus that this animal sticks to the shark, and drains away its moisture. The seamen, however, are of opinion, that it is seen to attend on the shark for more friendly purposes, to point him to his prey, and to apprise him of his danger. For this reason it has been called the Shark's Pilot.³

The shark so much resembles the whale in size, that some have injudiciously ranked it in the class of cetaceous fishes; but its real rank is in the place here assigned it, among those of the cartilaginous kind. It breathes with gills and lungs, its bones are gristly, and it brings forth several living young: Belonius assures us, that he saw a female shark produce eleven live young ones at a time. But I will not take upon me to vouch for the veracity of Rondeletius, who, when talking of the blue shark, says, that the female will permit her small brood, when in danger, to swim down her mouth, and take shelter in her belly. Mr. Pennant, indeed, seems to give credit to the story, and thinks that this fish, like the opossum, may have a place fitted by nature for the reception of her young. To his opinion much deference is due, and is sufficient at least to make us suspend our assent; for nothing is so contemptible as that affectation of wisdom which some display by universal incredulity.

Upon the whole, a shark, when living, is a very formidable animal; and, when dead, is of very little value. The flesh is hardly digestible by any but the Negroes, who are fond of it to distraction: the liver affords three or four quarts

³ In the month of May 1798, Citizen Geoffroy found himself between Cape Bon and the island of Malta, where, much fatigued with the long continuance of a calm, the attention of all the passengers was excited by a shark advancing towards the vessel. The two pilots which preceded him, were seen to direct their course towards the poop of the vessel, which they inspected twice from one end to the other; but finding that there was nothing which they might turn to their advantage, they resumed their former route: the shark never lost sight of his friends, but followed, as if he had been dragged by them. As soon as he was descried, one of the sailors threw a large hook into the sea, baited with lard. The three travellers, though they had already proceeded to the distance of 20 or 25 millemetres, hearing the noise occasioned by the fall of the bait, stopped short, and the two pilots detached themselves to examine the vessel; the shark, during their absence, sported on the surface of the water, turned himself on his back and dived, but always re-appeared at the same place. The pilots had no sooner discovered the lard, than they returned to their master with great velocity, made every effort to get before him, and then suddenly returned in the direction towards the vessel. They were followed by the shark, who appeared not to discover the lard, till the moment it was pointed out to him by his guides; it was then only that he began to swim with greater velocity, or rather made a jump to seize it, when the hook penetrated his lip, and he was immediately hoisted on board. It would be interesting to inquire into the causes of such a singular association, and to find out whether, according to the opinion of Cit Bosc, it is the dung of the shark that allures the pilot-fish.—Ed.

of oil; some imaginary virtues have been ascribed to the brain; and its skin is, by great labour, polished into that substance called shagreen. Mr. Pennant is of opinion, that the female is larger than the male in all this tribe; which would, if confirmed by experience, make a striking agreement between them and birds of prey. It were to be wished that succeeding historians would examine into this observation, which is offered only as a conjecture!

SUPPLEMENTARY NOTE.

About thirty species of sharks have been distinguished, of which twelve have been seen on the British coasts. Some, from pursuing their prey in concert, are called sea-dogs, hounds, and beagles. We may here particularize the Blue-shark, the Basking-shark, and the Angel-shark.

The Blue-shark.—The back of this shark is blue; the belly white. No orifices are to be seen behind the eye, as is usual with fish of this genus. Two white membranes, one to each eye, perform the office of eye-lids. When the head was placed downwards, a pretty large white pouch came out of its mouth. Ælian supposed this to serve as an asylum for the young in time of danger; and Mr. Pennant, who gives credit to the story, thinks that this fish, like the opossum, may have a place fitted by nature for the reception of her young. This, however, has been denied by some writers.

The Basking-shark.—This, though a very large fish, possesses none of the voracity and ferociousness that mark the generality of the shark tribe. It will frequently lie motionless on the surface of the water, generally on its belly, but sometimes on its back; and it seems so little afraid of mankind as often to suffer itself to be patted and stroked. Its body is slender, and from three to twelve yards in length; of a deep lead colour above, and white below. The upper jaw is blunt at the end, and much longer than the lower. The mouth is placed beneath, and furnished with small teeth; those before much bent, and the remote ones conical and sharp-pointed. On each side of the neck are five breathing apertures. There are two dorsal, two pectoral, two ventral fins, and one small anal fin. Within the mouth, near the throat, is a short kind of whale-bone. The liver is of such an immense size as frequently to weigh near a thousand pounds. From this a great quantity of good oil is extracted, which renders this shark an animal of considerable importance to the Scotch fishermen; for, according to Anderson, the oil of a single fish will sometimes sell for twenty or thirty pounds sterling. The basking-shark (which derives its name from its propensity to lie on the surface of the water, as if to bask itself in the sun) frequents our seas during the warm summer months, and is not uncommon on the Welch and Scottish coasts, where they come in shoals, usually after intervals of a certain number of years. In the intervening summers, those that are seen on the Welch coast are generally single fish, that have probably strayed from the rest. They appear in the frith of Clyde, and among the Hebrides, about midsummer, in small droves of seven or eight, or more commonly in pairs. Here they continue till the latter end of July, when they disappear.

The food of these sharks seems to consist entirely of marine plants, and some of the species of medusæ. They swim very deliberately, and generally with their upper fins above water. Sometimes they may be seen sporting about among the waves, and leaping several feet above the surface. The natives of our northern coasts are very alert in the pursuit, and

very dexterous in the killing of those fish. When pursued, they do not accelerate their motion till the boat comes almost in contact with them, when the harpooner strikes his weapon into the body as near the gills as he can. They seem not very susceptible of pain; for they often remain in the same place till the united strength of two men is exerted to force the harpoon deeper. As soon as they perceive themselves wounded, they plunge headlong to the bottom, and frequently coil the rope round their bodies in agony, attempting to disengage themselves from the fatal instrument by rolling on the ground. Discovering that these efforts are in vain, they swim off with such amazing rapidity, that one instance has occurred of a basking-shark pulling to some distance a vessel of seventy tons burden against a fresh gale. They sometimes run off with two hundred fathoms of line, and two harpoons in them; and will employ the men from twelve to twenty-four hours before they are subdued. As soon as they are killed, the fishermen haul them on shore; or, if at a distance from land, to the vessel's side, to cut them up and take out the liver, which is the only useful part of their bodies. This is melted into oil in kettles provided for the purpose; and if the fish be a large one, it yields eight barrels or upwards.

The Angel-shark.—This is very unlike the common sharks, being distinguished by its flat body, which forms the connecting link, as it were, between the genus of rays and that of sharks, as it partakes of the figure of both. The head is of a circular form, and rather broader than the body. The mouth is wide, and is situated at the extremity of the head. Like the sharks, the old fish of this species have more teeth than the young ones. Thus two angel-sharks, only a foot long, in the possession of Dr. Block, had only two rows of teeth in the upper jaw, and three in the lower; while Willoughby and Rondelet assert, that there are three in the former, and five in the latter. The fins are large and wide, and their resemblance to wings has probably procured this fish the denomination of angel. Of a certain portion of the skin the Turks make the most beautiful shagreen for watch-cases. The angel-shark is found in the Mediterranean and German ocean.

The Spotted dog-fish is an inhabitant of most seas, and measures four feet long; it is very voracious, and feeds chiefly upon fish. The body is reddish brown, with large distinct black spots; it is white beneath, and a little compressed at each end: the skin, when dried, is used for various purposes. The head is small, and the snout short; the eyes are oblong, and the pupil is of a sea-green colour; the iris of the eye is white; the mouth is oblong and wide, armed with three rows of teeth; the tongue is cartilaginous, and with the palate is rough; the nostrils are surrounded with a lobe and vermiform appendage; the vent is placed before the middle of the body, the ventral fins distinct; the first dorsal fin is placed behind the ventral; the second dorsal fin is less, and nearly opposite the anal; the tail is narrow, ending below in a sharp angle.

CHAP. III.

OF CARTILAGINOUS FLAT-FISH, OR THE RAY KIND.

THE same rapacity which impels the shark along the surface of the water, actuates the flat-fish at the bottom. Less active, and less formidable, they creep in security along the bottom, seize everything that comes in their way; neither the

hardest shells nor the sharpest spines give protection to the animals that bear them; their insatiable hunger is such, that they devour all; and the force of their stomach is so great that it easily digests them.

The whole of this kind resemble each other very strongly in figure; nor is it easy, without experience, to distinguish one from another. The stranger to this dangerous tribe may imagine he is only handling a skate, when he is instantly struck numb by the torpedo; he may suppose he has caught a thornback, till he is stung by the fire-flare. It will be proper, therefore, after describing the general figure of these animals to mark their differences.¹

¹ The bodies of all this tribe are broad, thin, and flat, the mouth is situated beneath, and the eyes on the upper surface of the head. The breathing apertures are five on each side, situated a little below the mouth. The head in general is small and pointed, and not distant from the body. Rays and their congeners are entirely oceanic fish, and from being destitute of an air-bladder to buoy them up, their chief residence is at the bottom of the ocean. They are viviparous, and seldom produce more than one at a time; which, as in the sharks, is enclosed in a four-cornered bag or shell, ending in slender points; but which are not filamentary like those of sharks. The liver of the ray tribe is large, and frequently produces a great quantity of oil. In a fresh state most of this tribe have a strong and unpleasant smell, but nearly the whole of them are eatable. The skate is considered by far the best food of the different species of this genus; the thornback being next to it in quality, but greatly inferior in point of flavour and richness, except when very young, in which case it is more palatable.

From the anatomical examination of a colossal species of this genus by Professor Mitchell, called by him the *Vampyrus*, it appears that their great power of progression is owing to their cartilaginous formation. He describes this species as having a scapula, humerus, ulna, carpus, and an uncommon number of phalanges of the before-mentioned cartilaginous structure. All these limbs or joints were articulated with each other; but the articulations, like those of the human sternum, had very little motion. From this articulated but fixed extremity, proceeded obliquely backwards seventy-seven rows of cartilage of different lengths, but of almost the same parallelism, and not at all radiated. They were all articulated, and the joints were very numerous. In the longest row they amounted to twenty-seven, and in the shorter ones proportionally fewer; the cartilages, with their articulations, were so alternated and diversified, that they, with the yielding and bending quality of the cartilage, were susceptible of all manner of flexion, and enabled the fish to assume all the attitudes requisite for its life and habits. In one of the pectoral fins, or what is equivalent to wings, the number of joints amounted to six hundred and twenty-three; from which some judgment may be formed of the vast variety of motions these organs are capable of performing, and how admirably they are adapted to connect strength with speed. We can hence understand why they fly so swiftly and powerfully through the water; why they can raise a spray or foam around them when they flap their fins on the surface; and how they are able, huge as they are, to gambol with agility, and even to leap out of the water for a considerable distance. The length of the animal which Professor Mitchell dissected, was ten feet nine inches from the margin of the head to the root of the tail,

All fish of the ray kind are broad, cartilaginous, swimming flat on the water, and having spines on different parts of their body, or at the tail. They all have their eyes and mouth placed quite under the body, with apertures for breathing either about or near them. They all have teeth, or a rough bone, which answers the same purpose. Their bowels are very wide toward the mouth, and go on diminishing to the tail. The tail is very differently shaped from that of other fishes; and at first sight more resembling that of a quadruped, being narrow, and ending either in a bunch or a point. But what they are chiefly distinguished by, is, their spines or prickles, which the different species have on different parts of their body. Some are armed with spines both above and below; others have them on the upper part only; some have their spines at the tail; some have three rows of them, and others but one. These prickles in some are comparatively soft and feeble; those of others, strong and piercing. The smallest of these spines are usually inclining towards the tail; the larger towards the head.

It is by the spines that these animals are distinguished from each other. The skate has the middle of the back rough, and a single row of spines on the tail. The sharp-nosed ray has ten spines that are situated towards the middle of the back. The rough ray has its spines spread indiscriminately over the whole back. The thornback has its spines disposed in three rows upon the back. The fire-flare has but one spine, but that indeed a terrible one. This dangerous weapon is placed on the tail, about four inches from the body, and is not less than five inches long. It is of a flinty hardness, the sides thin, sharp-pointed, and closely and sharply bearded the whole way. The last of this tribe that I shall mention is the torpedo; and this animal has no spines that can wound; but in the place of them it is possessed of one of the most potent and extraordinary faculties in nature.

Such are the principal differences that may enable us to distinguish animals, some of which are of very great use to mankind, from others that are terrible and noxious. With respect to their uses, indeed, as we shall soon see, they differ much; but the similitude among them, as to their nature, appetites, and conformation, is perfect and entire. They are all as voracious as they are plenty; and as dangerous to a stranger, as useful to him who can distinguish their differences.

Of all the larger fish of the sea, these are the most numerous; and they owe their numbers to their size. Except the white shark and cachalot alone, there is no other fish that has a swallow large enough to take them in; and their spines make them a still more dangerous morsel. Yet

—the breadth from one extremity of the pectoral fin to the other, measuring along the line of the belly was sixteen feet.—Ed.

the size of some is such, that even the shark himself is unable to devour them; we have seen some of them in England weigh above two hundred pounds; but that is nothing to their enormous bulk in other parts of the world. Labat tells us of a prodigious ray that was speared by the Negroes at Guadaloupe, which was thirteen feet eight inches broad, and above ten feet from the snout to the insertion of the tail. The tail itself was in proportion, for it was no less than fifteen feet long, twenty inches broad at its insertion, and tapering to a point. The body was two feet in depth; the skin as thick as leather, and marked with spots; which spots, in all of this kind, are only glands, that supply a mucus to lubricate and soften the skin. This enormous fish was utterly unfit to be eaten by Europeans; but the Negroes chose out some of the nicest bits, and carefully salted them up as a most favourite provision.²

Yet, large as this may seem, it is very probable that we have seen only the smallest of the kind; as they generally keep at the bottom, the largest of the kind are seldom seen; and as they may probably have been growing for ages, the extent of their magnitude is unknown. It is generally supposed, however, that they are the largest inhabitants of the deep; and were we to credit the Norway bishop, there are some above a mile over. But to suppose an animal of such a magnitude is absurd; yet the overstretching the supposition does not destroy the probability that animals of this tribe grow to an enormous size.

The ray generally chooses for its retreat such parts of the sea as have a black muddy bottom; the large ones keep at greater depths; but the smaller approach the shores, and feed upon whatever living animals they can surprise, or whatever putrid substances they meet with. As they are ravenous, they easily take the bait, yet will not touch it if it be taken up and kept a day or two out of water. Almost all fish appear much more delicate with regard to a baited hook than their ordinary food. They appear by their manner to perceive the line, and to dread it; but the impulse of their hunger is too great for their caution; and, even though they perceive the danger, if thoroughly hungry they devour the destruction.

These fish generate in March and April; at which time only they are seen swimming near the surface of the water, several of the males pursuing one female. They adhere so fast together in coition, that the fishermen frequently draw up both together, though only one has been hooked. The females are prolific to an extreme

² Fish of this genus have been captured of still larger dimensions. One taken in 1823, off the shore of New Jersey, measured 18 feet across; another taken off Port Royal, in 1824, was 15 feet in length and in breadth, and from three to four feet in depth. —ED.

degree; there having been no less than three hundred eggs taken out of the body of a single ray. These eggs are covered with a tough horny substance, which they acquire in the womb; for before they descend into that, they are attached to the ovary pretty much in the same manner as in the body of a pullet. From this ovary, or egg-bag, as it is vulgarly called, the fish's eggs drop one by one into the womb, and there receive a shell by the concretion of the fluids of that organ. When come to proper maturity, they are excluded, but never above one or two at a time, and often at intervals of three or four hours. These eggs, or purses, as the fishermen call them, are usually cast about the beginning of May, and they continue casting during the whole summer. In October, when their breeding ceases, they are exceedingly poor and thin; but in November they begin to improve, and grow gradually better till May, when they are in the highest perfection.

It is chiefly during the winter season that our fishermen take them; but the Dutch, who are indefatigable, begin their operations earlier, and fish with better success than we. The method practised by the fishermen of Scarborough is thought to be the best among the English; and, as Pennant has given a very succinct account of it, I will take leave to present it to the reader.

"When they go out to fish, each person is provided with three lines: each man's lines are fairly coiled upon a flat oblong piece of wicker-work; the hooks being baited and placed very regularly in the centre of the coil. Each line is furnished with two hundred and eighty hooks, at the distance of six feet two inches from each other. The hooks are fastened to lines of twisted horse-hair, twenty-seven inches in length.

"When fishing, there are always three men in each coble; and consequently nine of these lines are fastened together, and used as one line, extending in length near three miles, and furnished with above two thousand five hundred hooks. An anchor and a buoy are fixed at the first end of the line, and one more at each end of each man's lines; in all, four anchors, and four buoys made of leather or cork. The line is always laid across the current. The tides of flood and ebb continue an equal time upon our coast; and, when undisturbed by winds, run each way about six hours. They are so rapid that the fishermen can only shoot and haul their lines at the turn of the tide; and therefore the lines always remain upon the ground about six hours. The same rapidity of tide prevents their using hand-lines; and, therefore, two of the people commonly wrap themselves in the sail and sleep, while the other keeps a strict look-out, for fear of being run down by ships, and to observe the weather; for storms often rise so suddenly, that it is sometimes with extreme difficulty they escape to the shore, though they leave their lines behind them.

"The coble is twenty feet six inches long, and

five feet extreme breadth. It is about one ton burden, rowed with three pair of oars, and admirably constructed for the purpose of encountering a mountainous sea. They hoist sail when the wind suits.

"The five-men-boat is forty feet long, fifteen broad, and twenty-five tons burden. It is so called, though navigated by six men and a boy; because one of the men is hired to cook, and does not share in the profits with the other five. —All our able fishermen go in these boats to the herring-fishery at Yarmouth, the latter end of September, and return about the middle of November. The boats are then laid up until the beginning of Lent, at which time they go off in them to the edge of the Dogger, and other places, to fish for turbot, cod, ling, skate, &c. They always take two cobbles on board, and when they come upon their ground, anchor the boat, throw the cobbles, and fish in the same manner as when they go from the shore in a coble; with this difference only, that here each man is provided with a considerable quantity of lines, and, instead of waiting the return of the tide in the boat, they return to the boat, and bait their other lines, thus hauling one set, and shooting another, every turn of tide. They commonly run to the harbour twice a-week, to deliver their fish. The five-men-boat is decked at each end, but open in the middle, and has two long sails.

"The best bait for all kinds of fish, is fresh herring cut in pieces of a proper size; and, notwithstanding what has been said to the contrary, they are taken there at any time in the winter, and all the spring, whenever the fishermen put down their nets for that purpose: the five-men-boats always take some nets for that end. Next to herrings are the lesser lampreys, which come all winter by land-carriage from Tadcaster. The next baits in esteem are small haddocks cut in pieces, sand-worms, muscles, and limpets; and, lastly, when none of these can be found, they use bullock's liver. The hooks used there are much smaller than those employed at Iceland and Newfoundland. Experience has shown that the larger fish will take a living small one upon the hook, sooner than any bait that can be put on; therefore they use such as the fish can swallow. The hooks are two inches and a half long in the shank; and near an inch wide between the shank and the point. The line is made of small cording, and is always tanned before it is used. All the rays and turbot are extremely delicate in their choice of baits: if a piece of herring or haddock has been twelve hours out of the sea, and then used as a bait, they will not touch it."

Such is the manner of fishing for those fish that usually keep near the bottom on the coasts of England; and Duhamel observes, that the best weather for succeeding, is a half-calm, when the waves are just curled with a silent breeze.

But this extent of line, which runs, as we have seen, three miles along the bottom, is nothing to

what the Italians throw out in the Mediterranean. Their fishing is carried on in a tartan, which is a vessel much larger than ours; and they bait a line of no less than twenty miles long, with above ten or twelve thousand hooks. This line is called the *parasina*: and the fishing goes by that of the *pielago*. This line is not regularly drawn every six hours, as with us, but remains for some time in the sea, and it requires the space of twenty-four hours to take it up. By this apparatus they take rays, sharks, and other fish; some of which are above a thousand pounds weight. When they have caught any of this magnitude, they strike them through with a harpoon to bring them on board, and kill them as fast as they can.

This method of catching fish is obviously fatiguing, and dangerous; but the value of the capture generally repays the pain. The skate and the thornback are very good food, and their size, which is from ten pounds to two hundred weight, very well rewards the trouble of fishing for them. But it sometimes happens that the lines are visited by very unwelcome intruders; by the rough ray, the fire-flare, or the torpedo. To all these the fishermen have the most mortal antipathy; and, when discovered, shudder at the sight: however, they are not always so much upon their guard but that they sometimes feel the different resentments of this angry tribe; and, instead of a prize, find they have caught a vindictive enemy. When such is the case, they take care to throw them back into the sea with the swiftest expedition.

The rough ray inflicts but slight wounds with the prickles with which its whole body is furnished. To the ignorant it seems harmless, and a man would at first sight venture to take it in his hand, without any apprehension, but he soon finds, that there is not a single part of its body that is not armed with spines; and that there is no way of seizing the animal but by the little fin at the end of the tail.

But this animal is harmless, when compared to the fire-flare, which seems to be the dread of even the boldest and most experienced fishermen. The weapon with which nature has armed this animal, which grows from the tail, and which we described as barbed, and five inches long, hath been an instrument of terror to the ancient fishermen as well as the modern; and they have delivered many tremendous fables of its astonishing effects. Pliny, Ælian, and Oppian, have supplied it with a venom that affects even the inanimate creation: trees that are struck by it instantly lose their verdure, and rocks themselves are incapable of resisting the potent poison. The enchantress Circe armed her son with a spear headed with the spine of the trygon, as the most irresistible weapon she could furnish him with; a weapon that soon after was to be the death of his own father.

"That spears and darts," says Mr. Pennant,

"might in very early times have been headed with this bone instead of iron, we have no doubt. The Americans head their arrows with the bones of fishes to this day; and, from their hardness and sharpness, they are no contemptible weapons. But that this spine is possessed of those venomous qualities ascribed to it, we have every reason to doubt; though some men of high reputation, and the whole body of fishermen, contend for its venomous effects. It is, in fact, a weapon of offence belonging to this animal, and capable, from its barbs, of inflicting a very terrible wound, attended with dangerous symptoms; but it cannot be possessed of any poison, as the spine has no sheath to preserve the supposed venom on its surface; and the animal has no gland that separates the noxious fluid: besides, all those animals that are furnished with envenomed fangs or stings, seem to have them strongly connected with their safety and existence; they never part with them; there is an apparatus of poison prepared in the body to accompany their exertions; and when the fangs or stings are taken away, the animal languishes and dies. But it is otherwise with the spine of the fire-flare; it is fixed to the tail, as a quill is into the tail of a fowl, and is annually shed in the same manner; it may be necessary for the creature's defence, but it is no way necessary for its existence. The wound inflicted by an animal's tail, has something terrible in the idea, and may from thence alone be supposed to be fatal. From hence terror might have added poison to the pain, and called up imagined dangers: the Negroes universally believe that the sting is poisonous; but they never die of the wound; for by opening the fish, and laying it on the part injured, it effects a speedy cure. The slightness of the remedy proves the innocence of the wound.³

The Torpedo is an animal of this kind, equally formidable and well known with the former; but the manner of its operating is to this hour a mystery to mankind. The body of this fish is almost circular, and thicker than others of the ray kind; the skin is soft, smooth, and of a yellowish colour, marked, as all the kind, with large annular spots; the eyes very small; the tail tapering to a point; and the weight of the fish from a quarter to fifteen pounds. Redi found one twenty-four pounds weight.⁴ To all outward

³ The account of the venomous properties of this spine, as well as that it is shed annually, appears to be altogether fabulous. It is probable that, by its great strength, it may be able to inflict a painfully lacerated wound.—Ed.

⁴ The torpedo sometimes reaches the weight of seventy or eighty pounds. It is nearly of a circular form, four inches thick in the middle, and attenuating to extreme thinness in the edges. The skin is smooth, of a dusky brown colour above, and white underneath. The ventral fins form on each side, at the end of the body, nearly a quarter of a circle. The tail is short, and the two dorsal fins are placed near its origin. The mouth is small, and, as in the other species, there are on each side below it five

appearance, it is furnished with no extraordinary powers; it has no muscles formed for particularly great exertions; no internal conformation perceptibly differing from the rest of its kind; yet such is that unaccountable power it possesses, that, the instant it is touched, it numbs not only the hand and arm, but sometimes also the whole body. The shock received, by all accounts, most resembles the stroke of an electrical machine; sudden, tingling, and painful. "The instant," says Kempfer, "I touched it with my hand, I felt a terrible numbness in my arm, and as far up as the shoulder. Even if one treads upon it with the shoe on, it affects not only the leg, but the whole thigh upwards. Those who touch it with the foot, are seized with a stronger palpitation than even those who touch it with the hand.—This numbness bears no resemblance to that which we feel when a nerve is a long time pressed, and the foot is said to be asleep; it rather appears like a sudden vapour, which passing through the pores in an instant, penetrates to the very springs of life, from whence it diffuses itself over the whole body, and gives real pain. The nerves are so affected, that the person struck imagines all the bones of his body, and particularly those of the limb that received the blow, are driven out of joint. All this is accompanied with a universal tremor, a sickness of the stomach, a general convulsion, and a total suspension of the faculties of the mind. In short," continues Kempfer, "such is the pain, that all the force of our promises and authority could not prevail upon a seaman to undergo the shock a second time. A negro, indeed, that was standing by, readily undertook to touch the torpedo, and was seen to handle it without feeling any of its effects. He informed us, that his whole secret consisted in keeping in his breath; and we found, upon trial, that this method answered with ourselves. When we held in our breath, the torpedo was harmless; but when we breathed ever so little, its efficacy took place."

Kempfer has very well described the effects of this animal's shock; but succeeding experience

breathing apertures. The most extraordinary part of this animal is its electrical apparatus, which consists of a series of tubes situated on each side of the head and thorax, and which, on being touched, conveys a shock resembling that of a galvanic pile. This species is found in almost all the European seas, and is occasionally to be met with on the British coasts. The poet Oppian has described the properties of this fish, but has assumed a license, more poetical than true, that of ascribing to it the power of being able to benumb fishermen through the entire length of their line and rod; the description is as follows:—

The hook'd Torpedo ne'er forgets his art,
But soon as struck begins to play his part;
And to the line applies his magic sides;
Without delay the subtle power glides
Along the pliant rod and slender hairs,
Then to the fisher's hand as swift repairs;
Amaz'd he stands, his arms of sense bereft,
Down drops the idle rod, his prey is left:
Not less benumb'd than had he felt the whole
Of frost's severest rage, beneath the Arctic pole.—Ed.

has abundantly convinced us, that holding in the breath no way guards against its violence. Those, therefore, who depending on that receipt, should play with a torpedo, would soon find themselves painfully undeceived; not but that this fish may be many times touched with perfect security; for it is not upon every occasion that it exerts its potency. Reaumur, who made several trials upon this animal, has at least convinced the world that it is not necessarily, but by an effort, that the torpedo numbs the hand of him that touches it. He tried several times, and could easily tell when the fish intended the stroke, and when it was about to continue harmless. Always before the fish intended the stroke, it flattened the back, raised the head and tail, and then, by a violent contraction in the opposite direction, struck with its back against the pressing finger; and the body, which before was flat, became humped and round.

But we must not infer, as he has done, that the whole effect of this animal's exertions arises from the greatness of the blow which the fingers receive at the instant they are struck. We will, with him, allow the stroke is very powerful, equal to that of a musquet-ball, since he will have it so; but it is very well known, that a blow, though never so great, on the points of the fingers, diffuses no numbness over the whole body: such a blow might break the ends of the fingers indeed, but would hardly numb the shoulder. Those blows that numb, must be applied immediately to some great leading nerve, or to a large surface of the body; a powerful stroke applied to the points of the fingers will be excessively painful indeed, but the numbness will not reach beyond the fingers themselves. We must, therefore, look for another cause producing the powerful effects wrought by the torpedo.

Others have ascribed it to a tremulous motion which this animal is found to possess, somewhat resembling that of a horse's skin, when stung by a fly. This operating under the touch with an amazing quickness of vibration, they suppose produces the uneasy sensation described above; something similar to what we feel when we rub plush cloth against the grain. But the cause is quite disproportioned to the effect; and so much beyond our experience, that this solution is as difficult as the wonder we want to explain.

The most probable solution seems to be, that the shock proceeds from an animal electricity, which this fish has some hidden power of storing up, and producing on its most urgent occasions. The shocks are entirely similar; the duration of the pain is the same; but how the animal contrives to renew the charge, how it is prevented from evaporating it on contiguous objects, how it is originally procured, these are difficulties that time alone can elucidate.

But to know even the effects is wisdom. Certain it is, that the powers of this animal seem to decline with its vigour; for as its strength ceases,

the force of the shock seems to diminish; till, at last, when the fish is dead, the whole power is destroyed, and it may be handled or eaten with perfect security: on the contrary, when immediately taken out of the sea, its force is very great, and not only affects the hand, but if even touched with a stick, the person finds himself sometimes affected. This power, however, is not to be extended to the degree that some would have us believe; as reaching the fisherman at the end of the line, or numbing fishes in the same pond. Godignus, in his History of Abyssinia, carries this quality to a most ridiculous excess; he tells us of one of these that was put into a basket among a number of dead fishes, and that the next morning the people, to their utter astonishment, perceived that the torpedo had actually numbed the dead fishes into life again.

To conclude, it is generally supposed that the female torpedo is much more powerful than the male. Lorenzini, who has made several experiments upon this animal, seems convinced that its power wholly resides in two thin muscles that cover a part of the back. These he calls the trembling fibres; and he asserts that the animal may be touched with safety in any other part. It is now known also that there are more fish, than this of the ray kind, possessed of the numbing quality, which has acquired them the name of the torpedo. These are described by Atkins and Moore, and found in great abundance along the coast of Africa. They are shaped like a mackerel, except that the head is much larger; the effects of these seem also to differ in some respects. Moore talks of keeping his hand upon the animal; which in the ray torpedo it is actually impossible to do. "There was no man in the company," says he, "that could bear to keep his hand on this animal the twentieth part of a minute, it gave him so great pain; but upon taking the hand away, the numbness went off, and all was well again. This numbing quality continued in this torpedo even after it was dead; and the very skin was still possessed of its extraordinary power till it became dry." Condamine informs us of a fish possessed of the powers of the torpedo, of a shape very different from the former, and every way resembling a lamprey. This animal, if touched by the hand, or even with a stick, instantly benumbs the hand and arm up to the very shoulder; and sometimes the man falls down under the blow. These animals, therefore, must affect the nervous system in a different manner from the former, both with respect to the manner and the intention; but how this effect is wrought, we must be content to dismiss in obscurity.⁵

⁵ From a number of experiments made by Mr. Walsh, and communicated to the Royal Society, it appears that the powers of this animal are purely electric; though no spark could ever be discovered to proceed from it, nor were pith-balls ever affected

CHAP. IV.

OF THE LAMPREY, AND ITS AFFINITIES.

THERE is a species of the Lamprey served up as a great delicacy among the modern Romans, very different from ours. Whether theirs be the *maræna* of the ancients, I will not pretend to say; but there is nothing more certain than that our lamprey is not. The Roman lamprey agrees with the ancient fish in being kept in ponds, and considered by the luxurious as a very great delicacy.

The lamprey, known among us, is differently estimated, according to the season in which it is caught, or the place where it has been fed. Those that leave the sea to deposit their spawn in fresh waters are the best: those that are entirely bred in our rivers, and that have never been at sea, are considered as much inferior to the former. Those that are taken in the months of March, April, or May, just upon their leaving the sea, are reckoned very good; those that are caught after they have cast their spawn, are found to be flabby, and of little value. Those caught in

by it. "A live torpedo," says he, "was placed on a table; round another table stood five persons insulated; two brass wires, each thirteen feet long, were suspended from the ceiling by silken strings; one of these wires rested by one end on the wet napkin on which the fish lay; the other end was immersed in a basin full of water, placed on a second table, on which stood four other basins likewise full of water; the first person put a finger of one hand in the basin in which the wire was immersed, and a finger of the other hand in a second basin, the second person put a finger of one hand in this last basin, and a finger of the other hand in the third; and so on successively, till the five persons communicated with one another by the water in the basins. In the last basin, one end of the second wire was immersed, and with the other end Mr. Walsh touched the torpedo; when five persons felt a commotion, which differed in nothing from that of the Leyden experiment, except in the degree of force. Mr. Walsh, who was not in the circle of conduction, received no shock. The action of the torpedo is communicated by the same mediums as that of the electric fluid; and the bodies which intercept the action of the one, intercept likewise the action of the other. The effect produced by the torpedo, when in air, appeared, on many repeated experiments, to be about four times as strong as when in water. The numbness produced by the shock of the torpedo was imitated by artificial electricity, and shown to be producible by a quick concussion of minute shocks. This, in the torpedo, may be effected by the successive discharges of his numerous cylinders, the organs of its power, in the nature of a running fire of musquetry; the strong single shock may be his general volley. In the continued effect, as well as the instantaneous, his eyes, which are usually prominent, are withdrawn into their sockets. A coated vial was applied to it, but could not be charged.—Two other fishes are known to possess this extraordinary power: the Electric eel, which is able to give a shock even greater than the torpedo; and the Electric *silurus*, whose shock is much less vigorous than either of the others.—ED.

several of the rivers in Ireland, the people will not venture to touch; those of the English Severn are considered as the most delicate of all other fish whatever.¹

The lamprey much resembles an eel in its general appearance, but is of a lighter colour, and rather a clumsier make. It differs however in the mouth, which is round, and placed rather obliquely below the end of the nose. It more resembles the mouth of a leech than an eel; and the animal has a hole on the top of the head through which it spouts water, as in the cetaceous kind. There are seven holes on each side for respiration; and the fins are formed rather by a lengthening out of the skin, than any set of bones or spines for that purpose. As the mouth is formed resembling that of a leech, so it has a property resembling that animal, of sticking close to and sucking any body it is applied to. It is extraordinary the power they have of adhering to stones; which they do so firmly, as not to be drawn off without some difficulty. We are told of one that weighed but three pounds, and yet it stuck so firmly to a stone of twelve pounds, that it remained suspended at its mouth, from which it was separated with no small difficulty. This amazing power of suction is supposed to arise from the animal's exhausting the air within its body by the hole over the nose, while the mouth is closely fixed to the object, and permits no air to enter. It would be easy to determine the weight this animal is thus able to sustain; which will be equal to the weight of a column of air of equal diameter with the fish's mouth.

From some peculiarity of formation, this animal swims generally with its body as near as possible to the surface; and it might easily be drowned by being kept by force for any time under water. Muralto has given us the anatomy of this animal; but, in a very minute description, makes no mention of lungs. Yet I am very apt

¹ There are nine species of lampreys known.—The *Lesser Lamprey* inhabits Europe, Japan, and the lakes of South America; it measures from twelve to fifteen inches long; it ascends fresh-water rivers in the spring, and after a few months returns again to the sea. Its body is varied with transverse waved lines, above it is blackish, yellowish at the sides, and whitish beneath; its head is of a greenish colour; behind the row of lesser teeth there are larger ones, of which there are seven connected above, beneath there are two distant; the eyes are small; the iris is of a gold colour; towards the head there is the appearance of a lateral line; the fins are of a violet colour; and the second dorsal fin angulate.—The *Lamperna* is also an inhabitant of the European rivers, particularly the Isis, near Oxford; it is from six to seven inches long. It conceals itself under stones, or in the mud, and does not adhere to stones like the others; the body is round, and tapering at each end, and annulate; it is of a greenish colour above, yellowish at the sides, and white beneath; the mouth is lobate, and without teeth; the fins are hardly a line broad; the second dorsal fin is linear; the tail lanceolate, and sharp at the end.—ED.

to suspect, that two red glands tissue with nerves, which he describes as lying towards the back of the head, are no other than the lungs of this animal. The absolute necessity it is under of breathing in the air, convinces me that it must have lungs, though I do not know of any anatomist that has described them.

The adhesive quality in the lamprey may be, in some measure, increased by that slimy substance with which its body is all over smeared; a substance that serves at once to keep it warm in its cold element, and also to keep its skin soft and pliant. This mucus is separated by two long lymphatic canals, that extend on each side from the head to the tail, and that furnish it in great abundance. As to its intestines, it seems to have but one great bowel, running from the mouth to the vent, narrow at both ends, and wide in the middle.

So simple a conformation seems to imply an equal simplicity of appetite. In fact, the lamprey's food is either slime and water, or such small water-insects as are scarcely perceptible. Perhaps its appetite may be more active at sea, of which it is properly a native; but when it comes up into our rivers, it is hardly perceived to devour anything.

Its usual time of leaving the sea, which it is annually seen to do in order to spawn, is about the beginning of spring; and after a stay of a few months it returns again to the sea. Their preparation for spawning is peculiar; their manner is to make holes in the gravelly bottom of rivers; and on this occasion their sucking power is particularly serviceable; for if they meet with a stone of a considerable size, they will remove it, and throw it out. Their young are produced from eggs in the manner of flat-fish; the female remains near the place where they are excluded, and continues with them till they come forth. She is sometimes seen with her whole family playing about her; and after some time she conducts them in triumph back to the ocean.

But some have not sufficient strength to return; and these continue in the fresh-water till they die. Indeed the life of this fish, according to Rondeletius, who has given its history, is but of very short continuance; and a single brood is the extent of the female's fertility. As soon as she has returned after casting her eggs, she seems exhausted and flabby. She becomes old before her time; and two years is generally the limit of her existence.

However this may be, they are very indifferent eating after they have cast their eggs, and particularly at the approach of hot weather. The best season for them is the months of March, April, and May; and they are usually taken in nets with salmon, and sometimes in baskets at the bottom of the river. It has been an old custom for the city of Gloucester annually to present the king with a lamprey-pie; and as the gift is made at Christmas, it is not without great dif-

ficulty the corporation can procure the proper quantity, though they give a guinea a-piece for taking them.²

How much they were valued among the ancients, or a fish bearing some resemblance to them, appears from all the classics that have praised good living or ridiculed gluttony. One story we are told of this fish, with which I will conclude its history. A senator of Rome, whose name does not deserve being transmitted to posterity, was famous for the delicacy of his lampreys. Tigelinus Manucius, and all the celebrated epicures of Rome, were loud in his praises: no man's fish had such a flavour, was so nicely fed, or so exactly pickled. Augustus, hearing so much of this man's entertainments, desired to be his guest; and soon found that fame had been just to his merits; the man had indeed very fine lampreys, and of an exquisite flavour. The emperor was desirous of knowing the method by which he fed his fish to so fine a relish; and the glutton, making no secret of his art, informed him, that his way was to throw into his ponds such of his slaves as had at any time displeased him. Augustus, we are told, was not much pleased with his receipt, and instantly ordered all his ponds to be filled up. The story would have ended better if he had ordered the owner to be flung in also.

CHAP. V.

OF THE STURGEON, AND ITS VARIETIES.

The Sturgeon, with a form as terrible, and a body as large, as the shark, is yet as harmless as the fish we have been just describing; incapable and unwilling to injure others, it flies from the smallest fishes, and generally falls a victim to its own timidity.

The sturgeon, in its general form, resembles a fresh-water pike. The nose is long; the mouth is situated beneath, being small, and without jaw-bones or teeth. But though it is so harmless and ill-provided for war, the body is formidable enough to appearance. It is long, pentagonal, and covered with five rows of large bony knobs, one row on the back and two on each side, and a number of fins to give it greater expedition. Of this fish there are three kinds; the Common sturgeon, the Caviar sturgeon, and the Huso or Isinglass fish.¹ The first has 11 knobs or scales on the back; the second has 15; and the latter 13 on the back, and 43 on the tail. These differences seem slight to us who only consider the animal's form; but those who

² Henry I. of England died of a surfeit from eating lampreys.—ED.

¹ Five species of sturgeon are now known. The new are the *Ruthinus* and the *Stellatus*, both of which inhabit the Caspian Sea.—ED.

consider its uses find the distinction of considerable importance. The first is the sturgeon, the flesh of which is sent pickled into all parts of Europe. The second is the fish from the roe of which that noted delicacy called Caviar is made; and the third, besides supplying the caviar, furnishes also the valuable commodity of isinglass. They all grow to a very great size; and some of them have been found above eighteen feet long.

There is not a country in Europe but what this fish visits at different seasons; it annually ascends the largest rivers to spawn, and propagates in an amazing number. The inhabitants along the banks of the Po, the Danube, and the Wolga, make great profit yearly of its incursions up the stream, and have their nets prepared for its reception. The sturgeon also is brought daily to the markets of Rome and Venice, and they are known to abound in the Mediterranean sea. Yet those fish that keep entirely either in salt or fresh water are comparatively small. When the sturgeon enjoys the vicissitude of fresh and salt water, it is then that it grows to an enormous size, so as almost to rival even the whale in magnitude.

Nor are we without frequent visits from this much esteemed fish in England. It is often accidentally taken in our rivers in salmon-nets, and particularly in those parts that are not far remote from the sea. The largest we have heard of, caught in Great Britain, was a fish taken in the Eske, where they are most frequently found, which weighed four hundred and sixty pounds; an enormous size to those who have only seen our fresh-water fishes!

North America also furnishes the sturgeon: their rivers in May, June, and July, supply them in very great abundance. At that time they are seen sporting in the water, and leaping from its surface several yards into the air. When they fall again upon their sides, the concussion is so violent, that the noise is heard, in still weather, at some miles' distance.

But of all places where this animal is to be found, it appears nowhere in such numbers as in the lakes of Frischehauff and Curischaff, near the city of Pillau. In the rivers also that empty themselves into the Euxine sea, this fish is caught in great numbers, particularly at the mouth of the river Don. In all these places the fishermen regularly expect their arrival from the sea, and have their nets and salt ready prepared for their reception.

As the sturgeon is a harmless fish, and no way voracious, it is never caught by a bait in the ordinary manner of fishing, but always in nets. From the description given above of its mouth, it is not to be supposed that the sturgeon would swallow any hook capable of holding so large a bulk and so strong a swimmer. In fact, it never attempts to seize any of the finny tribe, but lives by rooting at the bottom of the sea, where it makes insects and sea-plants its whole subsist-

ence. From this quality of floundering at the bottom it has received its name; which comes from the German verb *floeren*, signifying to wallow in the mud. That it lives upon no large animals is obvious to all those who cut it open, where nothing is found in the stomach but a kind of slimy substance, which has induced some to think it lives only upon water and air. From hence there is a German proverb, which is applied to a man extremely temperate, when they say, he is as moderate as a sturgeon.

As the sturgeon is so temperate in its appetites, so is it also equally timid in its nature. There would be scarcely any method of taking it, did not its natural desire of propagation induce it to incur so great a variety of dangers. The smallest fish is alone sufficient to terrify a shoal of sturgeons; for, being unfurnished with any weapon of defence, they are obliged to trust to their swiftness and their caution for security. Like all animals that do not make war upon others, sturgeons live in society among themselves: rather for the purposes of pleasure than from any power of mutual protection. Gesner even asserts, that they are delighted with sounds of various kinds; and that he has seen them shoal together at the notes of a trumpet.

The usual time, as was said before, for the sturgeon to come up rivers to deposit its spawn, is about the beginning of summer, when the fishermen of all great rivers make a regular preparation for its reception. At Pillau, particularly, the shores are formed into districts, and allotted to companies of fishermen, some of which are rented for about three hundred pounds a-year. The nets in which the sturgeon is caught are made of small cord, and placed across the mouth of the river; but in such a manner that, whether the tide ebbs or flows, the pouch of the net goes with the stream.—The sturgeon thus caught, while in the water, is one of the strongest fishes that swims, and often breaks the net to pieces that encloses it; but the instant it is raised, with its head above water, all its activity ceases; it is then a lifeless, spiritless lump, and suffers itself to be tamely dragged on shore. It has been found prudent, however, to draw it to shore gently; for if excited by any unnecessary violence, it has been found to break the fisherman's legs with a blow of its tail. The most experienced fishers, therefore, when they have drawn it to the brink, keep the head still elevated, which prevents it doing any mischief with the hinder part of the body; others by a noose fasten the head and the tail together; and thus without immediately despatching it, bring it to the market, if there be one near, or keep it till their number is completed for exportation.

The flesh of this animal, pickled, is very well known at all the tables of Europe; and is even more prized in England than in any of the countries where it is usually caught. The fishermen have two different methods of preparing it. The

one is by cutting it in long pieces lengthwise, and, having salted them, by hanging them up in the sun to dry: the fish thus prepared is sold in all the countries of the Levant, and supplies the want of better provision. The other method, which is usually practised in Holland, and along the shores of the Baltic, is to cut the sturgeon crosswise, into short pieces, and put it in small barrels, with a pickle made of salt and saumure. This is the sturgeon which is sold in England; and of which great quantities came from the north, until we gave encouragement to the importation of it from North America. From thence we are very well supplied; but it is said, not with such good fish as those imported from the north of Europe.

A very great trade is also carried on with the roe of the sturgeon, preserved in a particular manner, and called Caviar: it is made from the roe of all kinds of sturgeon, but particularly the second. This is much more in request in other countries of Europe than with us. To all these high-relished meats, the appetite must be formed by degrees; and though formerly, even in England, it was very much in request at the politest tables, it is at present sunk entirely into disuse. It is still, however, a considerable merchandise among the Turks, Greeks, and Venetians. Caviar somewhat resembles soft soap in consistence; but is of a brown, uniform colour, and is eaten as cheese with bread. The manner of making it is this: they take the spawn from the body of the sturgeon—for it is to be observed, the sturgeon differs from other cartilaginous fish, in that it has spawn like a cod, and not eggs like a ray. They take the spawn, I say, and freeing it from the small membranes that connect it together, they wash it with vinegar, and afterwards spread it to dry upon a table; they then put it into a vessel with salt, breaking the spawn with their hands, and not with a pestle; this done, they put it into a canvass bag, letting the liquor drain from it; lastly, they put it into a tub, with holes in the bottom, so that, if there be any moisture still remaining, it may run out; then it is pressed down, and covered up close for use.

But the Huso or Isinglass fish furnishes a still more valuable commodity. This fish is caught in great quantities in the Danube, from the month of October to January: it is seldom under fifty pounds weight, and often above four hundred: its flesh is soft, glutinous, and flabby; but it is sometimes salted, which makes it better tasted, and then it turns red like salmon. It is for the commodity it furnishes that it is chiefly taken. Isinglass is of a whitish substance, inclining to a yellow, done up into rolls, and so exported for use. It is very well known as serviceable, not only in medicine, but many arts. The varnisher, the wine-merchant, and even the clothier, know its uses; and very great sums are yearly expended upon this single article of commerce. The manner of making it is this: they

take the skin, the entrails, the fins, and the tail of this fish, and cut them into small pieces; these are left to macerate in a sufficient quantity of warm water, and they are all boiled shortly after with a slow fire, until they are dissolved and reduced to a jelly; this jelly is spread upon instruments made for the purpose, so that drying, it assumes the form of parchment, and, when quite dry, it is then rolled into the form which we see in the shops.²

This valuable commodity is principally furnished from Russia, where they prepare great quantities surprisingly cheap. Mr. Jackson, an ingenious countryman of our own, found out an obvious method of making a glue at home that answered all the purposes of isinglass; but what with the trouble of making it, and perhaps the arts put in practice to undersell him, he was, as I am told, obliged to discontinue the improvement of his discovery. Indeed, it is a vain attempt to manufacture among ourselves those things which may be more naturally and cheaply supplied elsewhere. We have many trades that are unnaturally, if I may so express it, employed among us; who furnish more laboriously those necessities with which other countries could easily and cheaply supply us. It would be wiser to take what they can thus produce; and to turn our artisans to the increase and manufacture of such productions as thrive more readily among us. Were, for instance, the number of hands that we have now employed in the manufacture of silk, turned to the increase of agriculture, it is probable that the increased quantity of corn thus produced, would be more than an equivalent for the diminution of national wealth in purchasing wrought silk from other countries.

CHAP. VI.

OF ANOMALOUS CARTILAGINOUS FISHES.

OF all others, the Cartilaginous class seems to abound with the greatest variety of ill-formed animals; and, if philosophy could allow the expression, we might say, that the cartilaginous class was the class of monsters; in fact, it exhibits a variety of shapeless beings, the deviations of which from the usual form of fishes are beyond the power of words to describe, and scarcely of the pencil to draw. In this class we have the Pipe-fish, that almost tapers to a thread, and the Sun-fish, that has the appearance of a bulky head, but the body cut off in the middle; the Hippocampus, with a head somewhat like that of a horse, and the Water-bat, whose head can

² Isinglass is prepared from various other fishes, but principally from the White dolphin, or Beluga of North America. This well-known substance is made from the sound, or air-bladder.—ED.

scarcely be distinguished from the body. In this class we find the Fishing frog, which from its deformity some have called the Sea-devil; the Chimera, the Lump-fish, the Sea-porcupine, and the Sea-snail. Of all these the history is but little known; and naturalists supply the place with description.

The Sun-fish sometimes grows to a very large size; one taken near Plymouth was five hundred weight. In form it resembles a bream, or some deep fish cut off in the middle: the mouth is very small, and contains in each jaw two broad teeth, with sharp edges: the colour of the back is dusky and dappled, and the belly is a silvery white. When boiled, it has been observed to turn to a glutinous jelly, and would most probably serve for all the purposes of isinglass, were it found in sufficient plenty.

The Fishing Frog in shape very much resembles a tadpole or young frog; but then a tadpole of enormous size, for it grows to above five feet long, and its mouth is sometimes a yard wide. Nothing can exceed its deformity. The head is much bigger than the whole body; the under jaw projects beyond the upper, and both are armed with rows of slender sharp teeth: the palate and the tongue are furnished with teeth in like manner: the eyes are placed on the top of the head, and are encompassed with prickles: immediately above the nose are two long beards or filaments, small in the beginning, but thicker at the end, and round: these, as it is said, answer a very singular purpose; for being made somewhat resembling a fishing-line, it is asserted that the animal converts them to the purposes of fishing. With these extended, as Pliny asserts, the fishing frog hides in muddy waters, and leaves nothing but the beards to be seen: the curiosity of the smaller fish brings them to view these filaments, and their hunger induces them to seize the bait; upon which the animal in ambush instantly draws in its filaments, with the little fish that had taken the bait, and devours it without mercy. This story, though apparently improbable, has found credit among some of our best naturalists; but what induces me to doubt the fact is, that there is another species of this animal, that has no beards, which it would not want if they were necessary to the existence of the kind. Rondeletius informs us, that if we take out the bowels, the body will appear with a kind of transparence; and that if a lighted candle be placed within the body, the whole has a very formidable appearance. The fishermen, however, have in general a great regard for this ugly fish, as it is an enemy to dog-fish, the bodies of those fierce and voracious animals being often found in its stomach: whenever they take it, therefore, they always set it at liberty.

The Lump-fish is trifling in size, compared to the former: its length is but sixteen inches, and its weight about four pounds; the shape of the body is like that of a bream, deep, and it swims

edgeways; the back is sharp and elevated, and the belly flat; the lips, mouth, and tongue of this animal, are of a deep red; the whole skin is rough, with bony knobs; the largest row is along the ridge of the back; the belly is of a bright crimson colour: but what makes the chief singularity in this fish, is an oval aperture in the belly, surrounded with a fleshy soft substance that seems bearded all round; by means of this part it adheres with vast force to anything it pleases. If flung into a pail of water, it will stick so close to the bottom, that on taking the fish by the tail, one may lift up pail and all, though it holds several gallons of water. Great numbers of these fish are found along the coasts of Greenland in the beginning of summer, where they resort to spawn. Their roe is remarkably large, and the Greenlanders boil it to a pulp for eating. They are extremely fat, but not admired in England, being both flabby and insipid.

The Sea-snail takes its name from the soft and unctuous texture of its body, resembling the snail upon land. It is almost transparent, and soon dissolves and melts away. It is but a little animal, being not above five inches long. The colour, when fresh taken, is of a pale brown, the shape of the body round, and the back fin reaches all the way from the head to the tail. Beneath the throat is a round depression, of a whitish colour, surrounded by twelve brown spots, placed in a circle. It is taken in England at the mouth of rivers, four or five miles distant from the sea.

The body of the Pipe-fish, in the thickest part, is not thicker than a swan-quill, while it is above sixteen inches long. This is angular, but the angles being not very sharp, they are not discernible until the flesh is dried. Its general colour is an olive-brown, marked with numbers of bluish lines, pointing from the back to the belly. It is viviparous; for on crushing one that was just taken, hundreds of very minute young ones were observed to crawl about.

The Hippocampus, which, from the form of its head, some call the Seahorse, never exceeds nine inches in length. It is about as thick as a man's thumb, and the body is said, while alive, to have hair on the fore-part, which falls off when it is dead. The snout is a sort of a tube with a hole at the bottom, to which there is a cover, which the animal can open and shut at pleasure. Behind the eyes there are two fins which look like ears; and above them are two holes which serve for respiration. The whole body seems to be composed of cartilaginous rings, on the intermediate membranes of which several small prickles are placed. It is found in the Mediterranean, and also in the Western Ocean; and, upon the whole, more resembles a great caterpillar than a fish. The ancients considered it as extremely venomous; probably induced by its peculiar figure.

From these harmless animals, covered with a slight coat of mail, we may proceed to others,

more thickly defended, and more formidably armed, whose exact station in the scale of fishes is not yet ascertained. While Linnæus ranks them among the cartilaginous kinds, a later naturalist places them among the spinous class. With which tribe they most agree, succeeding observations must determine. At present we seem better acquainted with their figure than their history: their deformity is obvious; and the venomous nature of the greatest number has been confirmed by fatal experience.—This circumstance, as well as the happy distance at which they are placed from us, being all found in the Oriental or American seas, may have prevented a more critical inquiry; so that we know but little of the nature of their malignity, and still less of their pursuits and enmities in the deep.

In the first of this tribe we may place the Sea Orb, which is almost round, has a mouth like a frog, and is from seven inches to two feet long. Like the porcupine, from whence it sometimes takes its name, being also called the Sea Porcupine, it is covered over with long thorns or prickles, which point on every side; and, when the animal is enraged, it can blow up its body as round as a bladder. Of this extraordinary creature there are many kinds: some threatening only with spines, as the Sea Hedgehog; others defended with a bony helmet that covers the head, as the Ostracion; others with a coat of mail from the head to the tail, where it terminates in a point, as the *Centriscus*; and others still armed offensively and defensively with bones and spines, as the Shield Orb.

Of these scarcely one is without its peculiar weapon of offence. The *centriscus* wounds with its spine; the *ostracion* poisons with its venom; the orb is impregnable, and is absolutely poisonous if eaten. Indeed, their figure is not such as would tempt one to make the experiment; and the natives of those countries where they are found, are careful to inform foreigners of their danger: yet a certain sailor at the Cape of Good Hope, not believing what the Dutch told him concerning their venom, was resolved to make the experiment, and break through a prejudice, which, he supposed, was founded on the animal's deformity. He tried, and ate one; but his rashness cost him his life; he instantly fell sick, and died a few days after.

These frightful animals are of different sizes; some not bigger than a foot-ball, and others as large as a bushel. They almost all flatten and erect their spines at pleasure, and increase the terrors of their appearance in proportion to the approach of danger. At first they seem more inoffensive; their body oblong, with all their weapons pointing towards the tail; but, upon being provoked or alarmed, the body, that before seemed small, swells to the view; the animal visibly grows rounder and larger, and all its prickles stand upright, and threaten the invader on every side. The Americans often amuse themselves

with the barren pleasure of catching these frightful creatures by a line and hook, baited with a piece of sea-crab. The animal approaches the bait with its spines flattened; but when hooked and stopped by the line, straight all its spines are erected; the whole body being armed in such a manner at all points, that it is impossible to lay hold of it on any part. For this reason it is dragged to some distance from the water, and there it quickly expires. In the middle of the belly of all these there is a sort of bag or bladder filled with air, and by the inflation of which the animal swells itself in the manner already mentioned.

In describing the deformed animals of this class, one is sometimes at a loss whether it be a fish or an insect that lies before him. Thus the hippocampus and the pipe-fish bear a strong resemblance to the caterpillar and the worm; while the lesser orb bears some likeness to the class of sea-eggs to be described after. I will conclude this account of cartilaginous fishes with the description of an animal which I would scarcely call a fish, but that Father Labat dignifies it with the name. Indeed, this class teems with such a number of odd-shaped animals, that one is prompted to rank everything extraordinary of the finny species among the number: but besides, Labat says, its bones are cartilaginous, and that may entitle it to a place here.

The animal I mean is the Galley-fish, which Linnæus degrades into the insect tribe, under the title of the *Medusa*, but which I choose to place in this tribe, from its habits, that are somewhat similar. To the eye of an unmindful spectator, this fish seems a transparent bubble swimming on the surface of the sea, or like a bladder variously and beautifully painted with vivid colours, where red and violet predominate, as variously opposed to the rays of the sun. It is, however, an actual fish; the body of which is composed of cartilages, and a very thin skin filled with air, which thus keeps the animal floating on the surface, as the waves and the winds happen to drive. Sometimes it is seen thrown on the shore by one wave, and again washed back into the sea by another. Persons who happen to be walking along the shore often happen to tread upon these animals; and the bursting of their body yields a report like that when one treads upon the swim of a fish. It has eight broad feet, with which it swims, or which it expands to catch the air as with a sail. It fastens itself to whatever it meets by means of its legs, which have an adhesive quality. Whether they move when on shore, Labat could never perceive, though he did everything to make them stir; he only saw that it strongly adhered to whatever substances he applied it. It is very common in America, and grows to the size of a goose-egg, or somewhat more. It is perpetually seen floating; and no efforts that are used to hurt it can sink it to the bottom. All that ap-

pears above water is a bladder clear and transparent as glass, and shining with the most beautiful colours of the rainbow. Beneath, in the water, are four of the feet already mentioned, that serve as oars, while the other four are expanded above to sail with. But what is most remarkable in this extraordinary creature, is the violent pungency of the slimy substance with which its legs are smeared. If the smallest quantity but touch the skin, so caustic is its quality, that it burns like hot oil dropped on the part affected. The pain is worst in the heat of the day, but ceases in the cool of the evening. It is from feeding on these that he thinks the poisonous quality contracted by some West Indian fish may be accounted for. It is certain these animals are extremely common along all the coasts in the Gulf of Mexico; and whenever the shore is covered with them in an unusual manner, it is considered as a certain forerunner of a storm.

SUPPLEMENTARY NOTE.

The following is a description of a tobacco-pipe-fish taken at Salcomb in 1807.—Length twenty inches and a half, viz. ten to the vent, and ten and a half to the end of the tail: the snout similar to that of *acus*; its length to the eye three quarters of an inch; from thence to the end of the gill, including the eye, one inch: the form of the body rather compressed, and angular, with an acute dorsal and abdominal ridge, which, together with three slight angles on each side, gave it an octangular appearance; it was of equal size from the gills to the vent, which part contains about thirty plates; from the vent to the extremity of the tail it was almost round, and extremely taper, containing about sixty-six plates; immediately behind the vent, the body suddenly decreased to one-third less in diameter; but this may have been a sexual distinction.

The *Gar-fish* belongs to the class of needle-fish, which denomination they have received from the extreme length of their bodies in proportion to their thickness. They have no scales, but scuta or bucklers, with several angles. The hexagonal form of the body and the anal fin, are the distinguishing characters of the *gar-fish*. The body is composed of eighteen scuta, and the tail of thirty-six, which form as many joints; the tail is square. It is found in the North and Baltic seas; it scarcely exceeds the length of a foot, and the thickness of a finger. Besides the appellation of needle-fish and *gar-fish*, it is sometimes called by that of a shorter-pipe and horn-fish.

The *Needle-fish* are natives of the ocean and the North and Baltic seas. They are usually found in deep places near the coasts, where they are caught with other fish. They produce their young in a perfect state, one after the other, from eggs hatched in their bodies, like the sharks and rays. Having but little flesh they are fit only for baiting lines; and they are the more proper for this purpose as they are tenacious of life; and it is well known that fish bite more eagerly at a living bait than a dead one.

The *Sea-adder*, or little-pipe, is nearly round, having only some very small and scarcely perceptible angular projections on the sides. It has but one fin; and the body is divided into joints like that of the common worm. It grows to the length of two feet, and is not thicker than a swan's quill. It inhabits the North and Baltic seas, and is of the same nature as the two former fish.

The *Long File-fish* is not very deep on the body: the skin is divided by smooth furrows, with small rough scale-like spaces: each of these, on the sides, has a small spine pointing towards the tail; the first dorsal spine has three spines, the first of which is very large, and rough in front like a file, and hence the English name; the third very short, and situated at a considerable distance from the other two; the skin at the back and belly, at the base of the dorsal and anal fins drawn out and compressed; pectoral fins small; dorsal and anal fins triangular, and situate nearly opposite each other; the tail even at the end. A singular property is possessed by the first dorsal fin of this fish, which is, that no force can depress the first spine; but if the last be depressed in ever so gentle a manner, the other two immediately fall down upon it, and as instantaneously as when a cross-bow is let off by pulling the trigger. One sort found in the Mediterranean, near Rome, is on that account called *pisce balestra*, the Cross-bow fish.

There is another species, mentioned by Walcott, the body of which is much compressed and deep; the rays of the first dorsal fin, spiny; the first ray very long and rough; first dorsal fin, and the back from its base, black; skin rough; tail rough; and in the place of each ventral fin a long rough spine. Also another species (named *hispidus* by naturalists) is found in Carolina; the head fin of which is not radiated, and there is a round black spot in the tail fin. The body is rough, and bristly towards the tail. The spine, or horn, is situated between the eyes; and instead of a belly fin it has a jagged sharp spine. Several more species, or varieties, are found in the Indian ocean, and at Ascension island, all which, together with the unicorn, go by the general name of the *belestes*.

The *Eared Ostracion* has a brown spine over each eye, two on each side of the back, the same on each side of the abdomen, and one on each side of the body. Its teeth are cylindrical, blunt, and pointed forwards. The whole body is mailed with a complete bony covering. This species is found about the islands of the Pacific ocean, and is readily distinguished from the rest of its congeners. Its length is about four inches and a half.

The *Lineated Tetrodon* has bony jaws, and divided at the tip; the body is roughened beneath, and the ventral fins wanting; the abdomen is variegated by longitudinal brown bands. This singular fish, which is a native of the Mediterranean sea, is also said to be sometimes found in the river Nile. Like many others of its genus, it has a power of inflating at pleasure the skin of its body; and being covered on the abdomen with numerous small spines, is said to inflict considerable pain on the hands of those who incautiously touch it. It grows to the length of from eight to ten inches.

The *Orbicular Diodon* grows about a foot in length, and is a native of the tropical seas. It is of a rounder shape than the *Diodon Hystrix*, or Porcupine *Diodon*: its jaws are bony, and undivided; and the body beset with moveable spines. The spines are much shorter than the porcupine *diodon*, with broader bases, forming a kind of curved reticular pattern on the skin.

The *Scaly Centriscus* has its head lengthened into a very narrow snout; its mouth is toothless, with the lower jaw longer than the upper one. The gill-openings are wide; its body is compressed, with the abdomen carinated; and the ventral fins united. The *Scaly centriscus* or *Bellows fish* is a native of the Mediterranean sea, and grows to the length of five or six inches: it feeds on worms, and the smaller kinds of marine insects.

The *Telescope Fish* is of a beautiful red, darker towards the back, and lighter towards the belly: the membranes of the fins are almost white; and the red

rays shining through them have a very fine effect; the three white points of the tail give you an idea of a trident or tulip. The head is short, but large; the mouth is small; the nostrils single. The pupil of the eye is black, the iris yellow; the back is

round; the lateral line nearer the back than the head. The scales on the belly are large; the rays of the fins are ramified. This beautiful fish is found in the fresh waters of China, and is supposed to be a variety of the gold fish.

BOOK III.

OF SPINOUS FISHES.

CHAP. I.

THE DIVISION OF SPINOUS FISHES.

THE third general division of fishes is into that of the spinous or bony kind. These are obviously distinguished from the rest by having a complete bony covering to their gills; by their being furnished with no other method of breathing but gills only; by their bones, which are sharp and thorny; and their tails, which are placed in a situation perpendicular to the body. This is that class which alone our later naturalists are willing to admit as fishes. The cetaceous class with them are but beasts that have taken up their abode in the ocean; the cartilaginous class are an amphibious band, that are but half denizens of that element; it is fishes of the spinous kind that really deserve the appellation.

This distinction the generality of mankind will hardly allow; but whatever be the justice of this preference in favour of the spinous class, it is certain that the cetaceous and cartilaginous classes bear no proportion to them in number. Of the spinous classes are already known above four hundred species; so that the numbers of the former are trifling in comparison, and make not above a fifth part of the finny creation.

From the great variety in this class, it is obvious how difficult a task it must have been to describe or remember even a part of what it contains. When six hundred different sorts of animals offer themselves to consideration, the mind is bewildered in the multiplicity of objects that all lay some claim to its attention. To obviate this confusion, systems have been devised, which, throwing several fishes that agree in many particulars into one group, and thus uniting all into so many particular bodies, the mind that was incapable of separately considering each, is enabled to comprehend all, when thus offered in larger masses to its consideration.

Indeed, of all the beings in animated nature, fishes most demand a systematical arrangement. Quadrupeds are but few, and can be all known; birds, from their seldom varying in their size, can be very tolerably distinguished without system;

but among fishes, which no size can discriminate, where the animal ten inches, and the animal ten feet long, is entirely the same, there must be some other criterion by which they are to be distinguished; something that gives precision to our ideas of the animal whose history we desire to know.

Of the real history of fishes, very little is yet known; but of very many we have full and sufficient accounts, as to their external form. It would be unpardonable, therefore, in a history of these animals, not to give the little we do know; and, at least, arrange our forces, though we cannot tell their destination. In this art of arrangement, Artedi and Linnæus have long been conspicuous: they have both taken a view of the animal's form in different lights; and, from the parts which most struck them, have founded their respective systems.

Artedi, who was foremost, perceiving that some fishes had hard prickly fins, as the pike; that others had soft pliant ones, as the herring; and that others still wanted that particular fin by which the gills are opened and shut, as the eel, made out a system from these varieties. Linnæus, on the other hand, rejecting this system, which he found liable to too many exceptions, considered the fins not with regard to their substance, but their position. The ventral fins seem to be the great object of his system; he considers them in fishes supplying the same offices as feet in quadrupeds; and from their total absence, or from their being situated nearer the head or the tail, in different fishes, he takes the differences of his system.

These arrangements, which are totally arbitrary, and which are rather a method than a science, are always fluctuating; and the last is generally preferred to that which went before. There has lately appeared, however, a system composed by Mr. Gouan, of Montpellier, that deserves applause for more than its novelty. It appears to me the best arrangement of this kind that ever was made; and in it the divisions are not only precisely systematical, but in some measure adopted by Nature itself. This learned Frenchman has united the systems of Artedi and

Linnaeus together; and, by bringing one to correct the other, has made out a number of tribes that are marked with the utmost precision. A part of his system, however, we have already gone through in the cartilaginous, or, as he calls a part of them, the *branchiostegous* tribe of fishes. In the arrangement of these, I have followed Linnaeus, as the number of them was but small, and his method simple. But in that which is more properly called the *spinous class of fishes*, I will follow Mr. Gouan's system; the terms of which, as well as of all the former systems, require some explanation. I do not love to multiply the technical terms of a science; but it often happens that names, by being long used, are as necessary to be known as the science itself.

If we consider the substance of the fin of a fish, we shall find it composed, besides the skin, either of straight, hard, pointed, bony prickles or spines, as in the pike; or of soft, crooked, or forked bones, or cartilages, as in the herring.—The fish that have bony prickly fins, are called *prickly-finned fish*; the latter, that have soft, or cartilaginous fins, are called *soft-finned fish*. The prickly-finned fish have received the Greek new-formed name of *acanthopterygii*; the soft-finned fish have likewise their barbarous Greek name of *malacopterygii*. Thus far Artedi has supplied Mr. Gouan with names and divisions. All spinous fish are divided into prickly-finned fish and soft-finned fish.

Again, Linnaeus has taught him to remark the situation of the fins; for the ventral, or belly-fins, which are those particularly to be remarked, are either wholly wanting, as in the eel, and then the fish is called *apodal* (a Greek word, signifying 'without feet'); or the ventral-fins are placed more forward than the pectoral-fins, as in the haddock, and then the animal is a *jugular-fish*; or the ventral-fins are placed directly under the pectoral-fins, as in the father-lasher, and then it is called a *thoracic-fish*; or lastly, the ventral-fins are placed nearer the tail than the pectoral-fins, as in the minnow, and then it is an *abdominal-fish*.

Possessed of these distributions, the French naturalist mixes and unites them into two grand divisions. All the prickly-finned fish make one general division; all the soft-finned fish another. These first are distinguished from each other, as being either *apodal*, *jugular*, *thoracic*, or *abdominal*. Thus there are prickly-finned *apodal* fishes; prickly-finned *jugular* fishes; prickly-finned *thoracic* fishes; and prickly-finned *abdominal* fishes. On the other hand, the soft-finned fishes fall under a similar distribution, and make the other general division. Thus there are soft-finned *apodal* fishes, soft-finned *jugular* fishes, soft-finned *thoracic* fishes, and soft-finned *abdominal* fishes. These general characters are strongly marked, and easily remembered. It only remains, therefore, to divide these into such tribes as are most strongly marked by nature; and to give the distinct characters of each to form a

complete system with great simplicity. This Mr. Gouan has done; and the tribes into which he has distributed each of these divisions, exactly amount to fifty. Thus the reader, who can contain in his memory the characteristic marks of fifty kinds will have a tolerable idea of the form of every kind of spinous fish. I say, of the form; for as to the history and nature of the animal itself, that can only be obtained by experience and information.

SECT. I.—PRICKLY-FINNED FISHES.

Prickly-finned Apodal fish.

1. *The Trichurus.* The body of a sword-form; the head oblong; the teeth sword-like, bearded near the points; the fore-teeth largest; the fin that covers the gills with seven spines; the tail ending in a point without fins; an inhabitant near the Oriental and American shores; of a silvery white; frequently leaping into the fishermen's boats in China.

2. *The Xiphias, or Sword-fish.* The body round; the head long; the upper-jaw terminating by a long beak, in form of a sword; the fin that covers the gills with six spines; an inhabitant of Europe; an enemy to the whale.¹

¹ Sword-fish are very large and powerful animals, often growing to the length of twenty feet and upwards. Their voracity is unbounded, for they attack and destroy almost everything living that comes in their way. The larger fish they penetrate with their long snout, few of which, when within sight of them, can either withstand or avoid its shock. There are but two species, one of which is only found in the European seas; the other, called the Indian, or broad-finned sword-fish, inhabits the Brazilian and East Indian seas, and also the Northern ocean. The body of a silvery bluish white, except the upper parts of the back, and the head and tail, which are of a deep brown. The skin is smooth, and without any appearance of scales. From the long sharp-pointed process in front of the head, it would seem, on a cursory view, to be allied to the European species; but it differs from this in having an extremely broad back fin, and two long sharp-pointed appendages proceeding from the thorax.

In 1725, when his Majesty's ship *Leopard*, after her return from the coast of Guinea and the West Indies, was ordered to be cleaned and re-fitted for the channel service, in stripping off her sheathing the shipwrights found in her bottom, pointing in a direction from the stern towards the head, part of the sword or snout of one of these fish. On the outside this was rough, not unlike seal-skin; and the end, where it was broken off, appeared like a coarse kind of ivory. The fish, from the direction in which the sword lay, is supposed to have followed the ship when under sail. It had penetrated through her sheathing, which was an inch thick; passed through three inches of plank, and beyond that four inches into the timber. The force requisite to effect this (since the vessel sailed in a direction from the fish) must have been excessively great, especially as no shock was felt by the persons on board. The workmen on the spot, declared it impossible, with a hammer of a quarter of a hundred weight, to drive an iron pin of the same form and size into that wood and to the same depth, in less than nine strokes

3. The *Ophidium* or *Gilt-head*. The body sword-like; the head blunt; the fin covering the gills with seven spines; the opening of the mouth side-ways; the fins of the back, the anus, and the tail, all joining together; the most beautiful of all fishes, covered over with green, gold, and silver; it is by sailors called the dolphin, and gives chase to the flying-fish.

Prickly-finned Jugular fish.

4. The *Trachinus* or *Weever*. The body oblong; the head obtuse; the bones covering the gills jagged at the bottom; the fins covering the gills with six spines; the anus near the breast; buries itself in the sands, leaving only its nose out; and if trod upon immediately strikes with the spines that form its dorsal fins, which are venomous and dangerous.

5. The *Uranoscopus*. The body wedge-like; the head almost round, and larger than the body; the mouth flat; the eyes on the top of the head; the fin covering the gills with five spines; the anus in the middle of the body; an inhabitant of the Mediterranean Sea.

6. The *Callytonymus* or *Dragonet*. The body almost wedge-like; the head broad, and larger than the body; the mouth even with the body; the bony covering of the gills close shut; the opening to the gills behind the head; the fin covering the gills with six spines; an inhabitant of the Atlantic ocean.

7. The *Blennius* or *Blenny*. The body oblong; the head obtusely bevel; the teeth a single range; the fin covering the gills with six spines; the ventral-fins have two small blunt bones in each; a species of this animal is viviparous.

Prickly-finned Thoracic fish.

8. The *Gobius* or *Gudgeon*. The body round and oblong; the head with two little holes between the eyes, one before the other; the fin covering the gills with six spines; the ventral-fin joined together.²

whilst this had been effected by only one. A letter was written to Sir Joseph Banks, as president of the Royal Society, from the captain of an East India-man, about thirty years ago, accompanied with an account of another instance of the amazing strength which this fish occasionally exerts: the bottom of this ship having been pierced through in such a manner, that the sword was completely embedded or driven through its whole length, and the fish killed by the violence of the effort. A part of the bottom of the vessel, with the sword embedded in it, is now lodged in the British museum. The sword-fish and the whale are said never to meet without coming to battle; and the former has the repute of being always the aggressor. Sometimes two of them join against one whale, in which the combat is by no means equal. When the whale discovers the sword-fish darting upon him, he dives to the bottom, but is closely pursued by his antagonist, who compels him again to rise to the surface.—ED.

² There is another species, called the *Scorpio* or

9. The *Cepola*. The body sword-like; the head blunt; the mouth flat; the fin covering the gills with six spines; the fins distinct; an inhabitant of the Mediterranean Sea.

10. The *Coryphæna* or *Razor-fish*. The body wedge-like; the head very bevel; the fin covering the gills with five spines.

11. The *Skomber* or *Mackerel*. The body oblong; the line running down the side zigzagged towards the tail; the head sharp and small; the fins covering the gills with six spines; several false fins towards the tail.³

12. The *Labrus* or *Wrasse*. The body oval; the head middling; the lips doubled inward; both cutting and grinding teeth; the covers of the gills scaly; the fin covering the gills with five spines; the pectoral fins pointed.

13. The *Sparus* or *Sea-bream*. The body oblong; the head middling; the lips not inverted; the teeth cutting and grinding; the cover of the gills scaly; the fins covering the gills with five rays; the pectoral fins pointed.

14. The *Chatodon* or *Cat-fish*. The body oblong; the head small; the teeth slender and bending; the fin covering the gills with five or six spines; the fins of the back and anus scaly.

15. The *Sciæna*. The body nearly elliptical; the head bevel, the covers of the fins scaly; the fin covering the gills with six rays; the fins of the back jagged, and hidden in a furrow in the back.

16. The *Perch*. The body oblong; the head bevel; the covers of the gills scaly and toothed; the fin covering the gills with seven spines; the fins in some jagged.

17. The *Scorpena* or *Father-lasher*. The body oblong; the head great, with beards; the covers of the gills armed with prickles; the fin covering the gills with seven spines.

18. The *Mullus* or *Surmulet*. The body slender; the head almost four-cornered; the fin covering the gills with three spines; some of these have beards; a fish highly prized by the Romans, and still considered as a very great delicacy.

19. The *Trigla* or the *Gurnard*. The body slender; the head nearly four-cornered and covered with a bony coat, the fin covering the gills with seven spines; the pectoral and ventral fins, strengthened with additional muscles and bones, and very large for the animal's size.

Father-lasher, which is not uncommon on the rocky coasts of this island; it lurks under stones, and will take a bait. It seldom exceeds eight or nine inches in length. The head is large, and has a most formidable appearance, being armed with vast spines, which it can oppose to an enemy that attacks it, by swelling out its cheeks and gill-covers to a large size. The nose and space contiguous to the eyes are furnished with sharp spines; the covers of the gills are terminated by exceeding long ones, which are strong, and very sharp-pointed. The mouth is large: the jaws covered with very small teeth; the roof of the mouth is furnished with a triangular spot of very minute teeth.—ED.

³ See Note p. 301.

20. The *Cottus* or *Bull-head*. The body wedge-like; the head flat and broader than the body; the fin covering the gills with six spines; the head furnished with prickles, knobs, and beards.

21. The *Zeus* or *Doree*. The body oblong; the head large, bevel; the fin covering the gills with seven rays; the fins jagged; the upper-jaw with a loose floating skin depending into the month.

22. The *Trachipterus* or *Sabre*. The body sword-like; the head bevel; the fin covering the gills with six spines; the lateral line straight; the scales in a single order; a loose skin in both the jaws.

23. The *Gasterosteus* or *Stickleback*. The body broadest towards the tail; the head oblong; the fin covering the gills with three, six, or seven spines; prickles starting backward before the back fins and the fins of the anus.⁴

Prickly-finned Abdominal fish.

24. The *Silurus* or *Sheath-fish*. The body oblong; the head large; the fin covering the gills from four to fourteen spines; the leading bones or spines in the back and pectoral fins toothed.

25. The *Mugil* or *Mullet*. The body oblong; the head almost conical; the upper-jaw with a furrow, which receives the prominence of the under; the fin covering the gills with seven rays.

26. The *Polynemus*. The body oblong; the head with a beak; the fin covering the gills with from five to seven spines; the bones that move the pectoral fins not articulated to those fins.

27. The *Tenuthys*. The body almost elliptical; the head abruptly shortened; the fin covering

the gills with five rays; the teeth in a single row, close, strong, and even.

28. The *Elops* or *Sea-serpent*. The body slender; the head large; the fin covering the gills double, with thirty spines, and armed externally with five bones resembling teeth.

SECT. II.—SOFT-FINNED FISHES.

Soft-finned Apodal fish.

29. The *Muraena* or *Eel*. The body round and slender; the head terminating in a beak; the fin covering the gills with ten rays; the opening to the gills pipe-fashion, placed near the pectoral fins; the fins of the back, the anus, and the tail, united in one.

30. The *Gymnotus* or *Carapo*. The body broadest on the back, like the blade of a knife; the head small; the fin covering the gills with five rays; the back without a fin; two beards or filaments from the upper lip; an inhabitant of Brazil.⁵

31. The *Anarhicas* or *Wolf-fish*. The body roundish and slender; the head large and blunt; the fore-teeth above and below conical; the grind-

⁴ The *Fifteen-spined stickleback* or *Great stickleback* the largest species of the sticklebacks, is slender, being only an inch thick, and nine in length: the snout is long; and the body of a pentagonal figure towards the tail, which is flat. The mouth is small, and the upper jaw projects beyond the lower. The gills and the bony plate on the belly are brown upon the upper part, silvery and streaked upon the lower. It has two pectoral fins, one dorsal rising in a triangular form from the middle of the back; between this and the head are fifteen distinct spines inclined towards the tail, which, when depressed, are insensible to the touch. The fins of the belly consist of two spines, the foremost of which is the longest. In the fin at the anus there is also a covered spine, but the other fins are soft and ramified. The fifteen-spined sticklebacks, like the last-mentioned species, are found in the Baltic sea and the German ocean; they are very common in Holland, and also near Lubeck in the dutchy of Holstein. M. Bloch says, that their ordinary size does not exceed seven inches, and that he has found small crabs in their stomach. The great stickleback does not ascend the rivers like the other kinds, never leaving the sea, where it is taken among other fish. Large quantities are sometimes taken by kindling a fire on the shore, which draws them in shoals to the nets. A kind of lamp oil is extracted from them, and what remains is used as manure. They are, however, frequently eaten by the poor.—ED.

⁵ "Not only the crocodile and jaguar in South America lie in ambush for the horse, but even among fishes this animal has a dangerous enemy. The marshy waters of Bera and Rastro are filled with the electric eel, whose slimy yellow-spotted body sends forth at will terrible shocks. These gymnotes are from five to six feet long, and sufficiently strong to kill the most robust animals, when they bring their organs properly into action. At Uritucu they have been obliged to change the direction of the road, because the number of these eels had so much increased in a little river, that annually a number of horses in passing the ford were killed. All animals of their own element fly from these formidable eels; even man is surprised, when angling in the river, and receives the fatal shock by means of the wetted line. The fishing for the gymnote presents a picturesque spectacle. The Indians enclose a marshy spot and then drive horses and mules into the water, until the noise excites these courageous fishes to the attack. They are seen swimming on the surface like snakes, and adroitly insinuating themselves under the belly of the horses, many of which fall under the violence of these invisible blows, while others panting with streaming mane and haggard eyes, expressive of anguish, strive to evade the storm which threatens them; but the Indians, armed with long bamboos, drive them back again into the middle of the water. The impetuosity of this unequal combat at length diminishes. The gymnotes, fatigued, disperse, like clouds deprived of the electric fluid, and require long repose and abundant nourishment to repair the loss of the galvanic force. Their strokes getting feebler and feebler, produce a less sensible effect, until frightened at length by the trampling of the horses, they timidly approach the banks, and are then struck with harpoons by the Indians, and subsequently pulled on the steppe with dry sticks, non-conductors of the fluid." The *gymnotus electricus* was caught some time ago near Gravelines. The pilot of the vessel received a severe shock on taking it from the nets, and all the crew, on touching it, experienced a like sensation, which, however, weakened at every touch, and diminished gradually, till the animal expired.—ED.

ing teeth and those in the palate round: the fin covering the gills has seven rays.

32. The *Stromateus*. The body oblong; the head small; the teeth moderately sharp; the fin covering the gills with five or six rays.

33. The *Ammodytes* or *Launce*. The body slender and roundish; the head terminated by a beak; the teeth of a hair-like fineness; the fin covering the gills with seven rays.

Soft-finned Jugular fish.

34. The *Lepadogaster*. The body wedge-like; the head oblong, forwarder than the body, flattish, the beak resembling that of a duck; the pectoral fins double, two on each side; the ventral fins joined together; a kind of bony breast-plate between the pectoral fins; the fin covering the gills with five rays; the opening to the gills pipe-fashion.

35. The *Gadus* or *Cod-fish*. The body oblong; the head wedge-like; the fin covering the gills with seven rays; several back and annal fins.⁶

Soft-finned Thoracic-fish.

36. The *Pleuronectes* or *Flat-fish*. The body elliptical; the head small; both eyes on one side of the head; the fin covering the gills with from four to seven rays.⁷

⁶ The *Haddock* is a species of the cod. It has a bearded mouth, and three fins on the back; the upper jaw longest, and the tail a little forked. On each side of the body, just beyond the gills, there is a dark spot, which the superstitious assert is the impression of St. Peter's finger and thumb, when he took the tribute-money (at the command of his Master) out of the mouth of a fish of this species, and which has ever since been continued to the whole race of haddocks. Haddocks seldom grow to any great size; they very rarely become so large as to weigh twelve or fourteen pounds; they are esteemed more delicate eating when they do not exceed three pounds in weight. These fish, during stormy weather, are said to take shelter in the sand or mud, or among the sea-weeds. They feed on various small marine animals, and frequently become fat on herrings. The females deposit their spawn on the sea-weeds near the shore. The larger ones begin to be in roe in November, and continue so for somewhat more than two months; from this time till May they are reckoned out of season, and are not good. They then begin to recover. The small ones are extremely good from May till February; and those that are not old enough to breed, for even two months longer.

The whiting is another species of the cod, but without a beard.—Ed.

⁷ To this division the turbot, sole, flounder, plaice, dab, &c., belong. *Turbots* have sometimes been known to weigh from twenty-five to thirty pounds. Their general form is somewhat square. The upper parts of the body and fins are cinereous, with dark spots; and the under parts white: on the upper parts there are numerous short and blunt spines. The eyes are on the left side of the head.—The northern parts of the English coast, and some places off the coast of Holland, afford turbots in great abundance, and in greater excellence there than any other parts of the world. Lying here, however, in deep waters, they

37. The *Echineis* or *Sucking-fish*. The body almost wedge-like, moderately round; the head broader than the body; the fin covering the

are seldom to be caught but by lines. In fishing for turbot off the Yorkshire coast three men go out in each of the boats, each man provided with three lines, every one of which is furnished with two hundred and eighty hooks, baited and placed exactly six feet two inches asunder. These are coiled in an oblong piece of wicker-work, with the hooks baited and placed very regularly in the centre of the coil. When they are used, the nine are generally fastened together, so as to form one line with about two thousand hooks, and extending nearly three miles in length. This is always laid across the current. An anchor and a buoy are fixed at the end of each man's line. The tides run here so rapidly, that the fishermen can only shoot and haul their lines in the still water, at the turn of the tide; and therefore as it is flood and ebb about every alternate six hours, this is the longest time the lines can remain on the ground. When the lines are laid, two of the men usually wrap themselves in the sail and sleep, whilst the third is on watch to prevent their being run down by ships. The voracity of the turbot in pursuit of its prey is oftentimes such, that it carries them into the mouths of rivers, or the entrance of ponds in salt marshes, which communicate with the sea. But they are not contented with merely employing agility and strength in the procuring of their prey, they likewise have recourse to stratagem. They plunge themselves into the mud or sand at the bottom of the sea, and cover their whole body, except their eyes and mouth. Thus concealed, they seize upon, and devour all the smaller kinds of fish which incautiously approach them. It is said they are very particular in the choice of their food, refusing, invariably, all except living animals, or such as are not in the least degree putrid. And the fishermen assert, that they are never to be caught with baits which have been bitten by other fish. The *Holibut* has been known to attain so great a weight as between two and three hundred pounds. Its general shape is long and narrow. The upper parts are dusky; and the under parts white. The skin is smooth, and destitute of spines. The eyes on the right side of the head.

The *Sole* is remarkable for one very extraordinary circumstance; among various other marine productions, they have been known to feed on shell-fish, although they are furnished with no apparatus whatever in their mouth for reducing them to a state calculated for digestion. Some that were purchased by Mr. Collinson, had their bellies hard and prominent, appeared to be filled with rows of some hard substance, which, on being opened, were found to be shell-fish. These, from the bulging of the shells and the intervening interstices, gave the intestines somewhat the appearance of strings of beads. On further examination, some of them were found nearly dissolved, others partly so, but many of them whole. The most usual food of soles is the spawn and young of other fish. These fish are found on all the British coasts; but those of the western shores are much superior in size to what are taken in the north, since they are sometimes found of the weight of six or seven pounds. The principal fishery for soles is in Torbay.

The *Bearded Flounder* has its eyes both on the same side of the head. The body is compressed, one side representing the back, and the other the abdomen. The whole body is scattered with gray spots; and it is bearded all round the fore-part of the head. This fish is a native of the Indian and Red seas, measuring seven or eight inches in length.

the gills with ten rays; an oval breast-plate, streaked in the form of a ladder, toothed.⁸

38. The *Lipidopus* or *Garter-fish*. The body sword-like, the head lengthened out; the fins covering the gills with seven rays; three scales only on the whole body; two in the place of the ventral fins; and the third from that of the anus.

Soft-finned Abdominal fish.

39. The *Loricaria*. The body crusted over; the head broad with a beak; no teeth; the fin covering the gills with six rays.

40. The *Atherina* or *Atherine*. The body oblong; the head of a middling size; the lips indented; the fin covering the gills with six rays; the line on the sides resembling a silver band.

41. The *Salmo* or *Salmon*. The body oblong; the head a little sharp; the fin covering the gills with from four to ten rays; the last fin on the back, without its corresponding muscles, fat.⁹

It seems to have been first considered a distinct species by Gronovius, but does not occur in the *Systema Nature* of Linnæus.

Plaice are very flat, and much more square than the generality of flat fish. Behind the left eye there is a row of six tubercles, that reaches to the commencement of the lateral line. The upper part of the body and fins are of a clear brown, marked with large bright orange-coloured spots; the belly is white. These fish are very common on most of our coasts, and sometimes taken of the weight of fifteen pounds; but they seldom reach that size, one of eight or nine pounds being reckoned a large fish. The best and largest are taken off Rye, on the coast of Sussex, and in Ireland; also off the Dutch coasts. They are watery eating; but are, notwithstanding, admired by some. They spawn in the beginning of February.

The *Dab* is found with the preceding species, but is less common. It is generally of a uniform brown colour on the upper side, though sometimes clouded with a darker. The scales are small and rough, which is a character of this species. The lateral line is extremely incurved in the beginning, then goes quite straight to the tail. The lower part is white. This fish is in best season during February, March, and April; they spawn in May and June, and become flabby and watery the rest of the summer. They are superior in quality to the plaice and flounder, but rather inferior in size.—Ed.

⁸ The Sucking-fish was believed by the ancients to have the power of arresting the progress of a vessel by adhering to its bottom. They are found adhering to the sides of sharks and other fish, and have been employed by the Indians in catching fish somewhat in the same manner as hawks are in seizing birds.—Ed.

⁹ The *Salmon*, which was known to the Romans, but not to the Greeks, is a soft-finned abdominal fish. It is distinguished from other fish by having two dorsal fins, of which the hindermost is fleshy and without rays: it has teeth both in the jaws and in the tongue; and the body is covered with round and minutely striated scales. The colour of the back and sides is gray, sometimes spotted with black, and sometimes plain; the covers of the gills are subject to the same variety; and the belly is silvery. The nose is sharp-pointed; and in the males the under jaw sometimes turns up in the form of a hook. Ra-

42. The *Pistularia*. The body angular, in form of a spindle; the head pipe-fashion, with a beak; the fin covering the gills with seven rays; the under jaw covering the upper.

pid and stony rivers, where the water is free from mud, are the favourite places of most of the salmon tribe, the whole of which is supposed to afford wholesome food for mankind. This fish seems confined in a great measure to the northern seas, being unknown in the Mediterranean, and in the waters of other climates. It lives in fresh as well as in salt waters, forcing itself in autumn up the rivers, sometimes for hundreds of miles, for the purpose of depositing its spawn. It abandons the seas where it finds an abundant sustenance, ascends the rivers depopulated by man, endeavours by every kind of artifice to escape the snares of the fishermen, and all this solely for the purpose of finding a convenient place for depositing its eggs. In these peregrinations it is that salmon are caught in the great numbers that supply our markets and tables. Intent only on the object of their journey, they spring up cataracts and other obstacles of a very great height. This extraordinary power seems to be owing to a sudden jerk that the fish gives to its body from a bent into a straight position. When they are unexpectedly obstructed in their progress, it is said they swim a few paces back, survey the object for some minutes, motionless, retreat, and return again to the charge; then, collecting all their force, with one astonishing spring leap over every obstacle. Where the water is low, or sand-banks intervene, they throw themselves on one side, and in that position soon work themselves over into the deep water beyond. On the river Liffey, in Ireland, there is a cataract above nineteen feet high; here, in the salmon season, many of the inhabitants amuse themselves in observing the fish leap up the torrent. They frequently fall back many times before they surmount it; and baskets, made of twigs, are placed near the edge of the stream to catch them in their fall.

The development and growth of the salmon, or, in other words, the history of salmon fry, as must be known to many of our readers, has for many years been regarded, by all competent judges, as a most difficult, vexatious, and nearly interminable subject. Nor has it been considered less important than difficult. The subject of the Salmon fisheries is very much involved in it, one of national importance, which, of late years, notwithstanding repeated parliamentary interference, has fearfully declined. Nothing can be more clear than that, until the true history of the salmon and its fry has been accurately made out, legislation must proceed in the dark, and its enactments will probably not only be wide of the mark, but decidedly injurious.

This long and vexatious question has at length been brought to a close by the steady and unaided investigations of Mr. John Shaw, a most respectable individual in the employment of the Duke of Buccleuch, at Drumlanrig, who, in the face of considerable opposition, pursued the even tenor of his way, by the simple but satisfactory method of experiment. He has discovered and proved that the small river fish, so well known throughout Scotland, under the name of parr, and in various localities throughout the empire as pinks, brandlings, samlets, fingerlings, &c., &c., and scarcely more known than disesteemed as of little or no intrinsic value, are nothing less than the young of the true salmon, *Salmo salar*. That this is a real discovery need scarcely be demonstrated, inasmuch as nearly all the most recent Ichthyological writers, and other naturalists, have, up to the present time, been, we believe, unanimous in their opinions regarding the specific differences be-

43. The *Esox* or *Pike*. The body round; the head with a beak; the under jaw pierced longitudinally with small holes; the fin covering the gills with from seven to twelve rays.

tween these parrs and the young salmon fry. We might quote in detail the authorities of Wilson, Yarell, Jardine, Parnell, and many others on this point, but we shall adduce the words of one only of these distinguished naturalists, and this merely as a specimen of the rest. "I consider the parr not only distinct, but one of the best and most marked species we have, and that it ought to remain in our systems as the *Salmo samulus* of Ray." It is this universally received opinion that Mr. Shaw has had the ability and good fortune to overturn—to the satisfied conviction of those that, a few months ago, were most opposed to his views—leaving, so far as we know, not a lingering doubt behind; and hence a rich reward to his persevering assiduity, leading probably to public profit, as it abundantly has to his private honour; one proof of which is to be found in its having led the Council of the Royal Society of Edinburgh to come to the unanimous decision of bestowing upon him its Keith biennial medal, for the most important communication presented within the period—an award honourable to the donors, and still more to the receiver. Of this discovery we shall now present a concise view. The author must have been engaged with the investigation for a period of some five or six years, as he first published some of his views as far back as July 1836, in the 'Edinburgh Philosophical Journal.' In December 1837, his first paper on the subject was read to the Royal Society of Edinburgh, and his second in December 1839. Instead, however, of attempting to analyze any of these communications in chronological order, we shall produce, in few words, some of the abundant evidence he has supplied.

Familiar with the breeding-beds in the river Nith, Mr. Shaw first removed some salmon spawn which had been deposited and fecundated in the usual way, and placed it in artificial ponds, which he had constructed with great care, and which he effectually guarded against everything like foreign mixture. This afforded him an excellent opportunity of examining the development of the spawn, and of tracing the future history of the young fish; and he found that these little creatures of his ponds were in every respect the same as the parrs of the river. This was the first proof that the parr was nothing else than the genuine fry of the young salmon; but as there remained something like ground for scepticism, he next thought of so regulating the spawning process, that no suspicion or doubt could remain as to the authenticity and purity of the breed. He accordingly secured a great female salmon in the act of spawning, and isolated her in a pool at the river side; from this pool he cut a trench, which he made to communicate with an artificial bed, hollowed out by himself. The sides of the female, thus isolated, were now gently pressed, the spawn floated along the trench, and rested in the artificial bed. This effected, a great male salmon was next introduced into the pool; his milt was in like manner shed, flowed along the same trough, and reposed in the same bed. After a while, this fecundated spawn was removed to the experimental pond, was maintained free from all subsequent contamination, and its future history, from the ovum and for many months, demonstrated that it was a parr, agreeing with the common river ones, and in nothing distinguishable from them. Hence the inference was conclusive that the young of the salmon was really the parr. But the parr being the young of the salmon, it must needs follow that with age these parr will

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44. The *Argentina* or *Argentine*. The body a little round and slender; the head with a beak, broader than the body; the fin covering the gills with eight rays; a spurious back-fin.

assume the appearance of salmon, and this Mr. Shaw has most effectually demonstrated. In his experimental ponds he detained the parr, and noticed their successive changes. Whilst yet undistinguishable in appearance, and allowed by all competent judges to be genuine parr, he killed and preserved some to serve as objects of comparison, and found that after a given time, the whole remaining fry changed its dress and its habits, and now could be regarded by no one as the previously considered distinct species of parr; but, on the other hand, was acknowledged by all to be genuine young salmon, in their silvery migratory livery. The effects of the surrounding temperature on this change were all carefully noted by Mr. Shaw, but our space forbids us to state them. Suffice it to note, that the spawn deposited the end of January left the ova only on the 10th of May, the very day on which large shoals of salmon fry were descending towards the ocean. These shoals have generally been regarded as the spawn of the same year, whereas they were far advanced in their second year's growth.

But this is not all. Every one who has attended to the habits of salmon is aware that during the process of spawning, the adult female is frequently attended not by the adult male, but by the tiny parr, whose milt during the while is copiously flowing in due proportion to that of the female spawn. Mr. Shaw conceived that this might be proof, however singular the occurrence, of the identity of the species; and this he determined to subject to the test of experiment. Accordingly, he repeated, in an isolated pool, with the adult female salmon and the parr, the experiment which has already been related of the adult salmon. The milt of the parr, thus brought into contact with the spawn of the salmon, was removed from the artificial bed into the experimental pond, and was found in the course of months to exhibit precisely the same appearances, first, of true parr, and then of genuine silvery salmon fry, as the others had done. In the view that here there was not complete identity of species, the latter brood would be considered hybrid, and, according to the generally received notions, mules or neuters, and so incapable of propagating their kind. This point also has been investigated by Mr. Shaw, and, finally, one of those, by possibility, hybrids has been made to play the part of the true male salmon, and the acknowledged genuine parr, and with precisely the same result, so that his progeny has been as distinctly, as in the other cases, first, the true parr, and then the undisputed young salmon.

The *Trout* is rather long than broad: in several of the Scotch and Irish rivers, they grow so much thicker than those in England, that a fish from eighteen to twenty-two inches will often weigh from three to five pounds. This is a fish of prey; has a short roundish head, blunt nose, wide mouth filled with teeth, not only in the jaws, but in the palate and tongue; the scales are small; the back of an ash-colour; the sides yellow; and, when in season, is sprinkled all over the body and covers of the gills with small beautiful red and black spots; the tail is broad. The female has a smaller head and deeper body than the male, and is of superior flavour. In fact, the colour of the trout and its spots vary greatly in different waters, and at different seasons. This fish, although very delicate, and at present well known, was in no esteem among the ancients. It abounded in most of the lakes of the Roman empire, yet is only mentioned by writers on account of its

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45. The *Clupea* or *Herring*. The body a little oblong; the head with a small beak; the fin covering the gills with eight rays.

46. The *Esocetus* or *Flying-fish*. The body ob-

autiful colours. In some rivers trouts begin to spawn in October, but November is the chief month of spawning. About the end of September they quit the deep water to which they had retired during the hot weather, and make great efforts to gain the course of the currents, seeking out a proper place for spawning. This is always on a gravelly bottom, or where gravel and sand are mixed among stones towards the end and sides of the streams. At this period they turn black about the head and body, and become soft and unwholesome. They are never good when they are big with roe, which is contrary to the nature of most other fish. They multiply very fast, though they produce much less spawn than any other fish, which is probably owing to the voracious fish in those cold streams where they reside; and they would be still more numerous, if they were not so greedy as to devour each other. After spawning they become feeble, their bodies are wasted, and those beautiful spots, which before adorned them, are imperceptible; their heads appear swelled, and their eyes are dull. In this state they seek still waters, and continue there sick, as is supposed, all the winter. There are in all trout rivers some barren female fish, which continue good throughout the winter. These fish begin to leave their winter-quarters in March, or sometimes earlier, if the weather be mild, and approach the shallows and tails of streams, where they cleanse and restore themselves. As they acquire strength they advance still higher up the rivers, till they fix on their summer residence; for which they generally choose an eddy behind a stone, a log, or bank, that projects into the water, and against which the current drives. The varieties of the common trout are almost infinite; from the great lake trout, which weighs above 60 or 70 lbs., to the trouts of the little mountain-brook, which is scarcely larger than the finger. The gillaroo trout and parr, samlet or brandling may be considered as forming distinct species.

The *Salmon-trout*, so called from its resemblance to the two fish whose name it bears, attains the size of a small salmon; is spotted in the same manner as the trout; and, like it, spawns in winter. Like the salmon it sometimes inhabits the sea, and sometimes the rivers; it likewise ascends into the latter to deposit its spawn. The salmon-trouts, however, do not quit the sea so early as the salmon, being seldom seen in the rivers before the month of May. They spawn in the same manner as salmon, in November or December; but as the rivers are then frozen, they do not retire to the sea till after the thaw. Like all other fish of the same genus, they live upon aquatic insects, worms, and small fish, and are fond of rapid streams, with a bottom of sand and gravel. Their flesh is red and well-tasted, particularly before the spawning-season. Its quality depends, in a great measure, on the greater or less degree of purity of the streams in which the fish are taken; their colour and spots vary extremely from the same cause. They die soon after they are taken out of the water. Young salmon trout are known by the name of whilings; and many have supposed them to be young salmon, which opinion has been proved to be ill-founded. Salmon-trouts attain a considerable size, weighing sometimes eight or ten pounds. Dr. Bloch describes one that was twenty inches in length, an inch and a half thick, and which weighed five pounds and three quarters. This gentlemen discovered, that this fish, like several kinds of sea-fish, possesses the quality of emitting light in a dark place;

long; the head almost three-cornered; the fin covering the gills with ten rays; the pectoral fins placed high, and as long as the whole body; the back-fin at the extremity of the back.¹⁰

and that the palate, tongue, gills, and eyes, were endowed with that property in an eminent degree. When touched with the finger, those parts cast a considerable light; and when any other part was rubbed with the same finger, that quality was likewise communicated to it. The luminous matter, the doctor imagines, is contained in the slimy substance which covers those parts; for the flesh does not afford the smallest appearance of light. He kept fish eight days, and this luminous property diminished in proportion as the viscous matter was dried up.

The *Grayling* is a scarce fish in England, and is not to be found in Scotland or Ireland. They frequent rivers of peculiar temperature and current.—
ED.

¹⁰ The animals of the ocean seem to correspond in their general habits to those of the land—one portion depending upon an erratic mode of life for subsistence, like the wandering Arabs of the desert, and the other upon a sedentary life, like the domesticated ones of the plain. The erratic tribes of the ocean, however, have this advantage over those of the land, that, while the green oases scattered thinly over the deserts of the latter, and the caravans at chance intervals traversing them, afford but an uncertain supply to its roaming hordes, those of the ocean derive always an abundance in the variety of the finned fishes, and the gelatinous mollusca and spawn which the latter contains; the smaller finned tribes preying upon the mollusca and spawn, and the larger again upon the smaller, until their eventual decease enables the mollusca in turn to prey upon them. The animal species has, by an eminent naturalist, been compared to a circle, into which all are progressively united by successive connecting links; and it may be only a high philosophic enthusiasm for practically demonstrating the truth of this circular theory, which induces them to eat each other in a circle also. Of all the smaller erratic fishes, the flying species is the most interesting, in consequence of its being one of the singular links connecting the fish with the bird tribe, its length seldom exceeding a foot, its shape roundish, and tapering from the head to the tail, with a long fin projecting out on each side of its centre of balance, to be applied either to swimming or flying, according as exigencies may require. It is not, however, a universal wanderer; like most of the other deep-sea fishes, its range of feeding-ground is confined to the latitudes of the trade winds, most probably in consequence of its slender filmy wings and delicate form rendering it unfit to encounter the rough buffetings of the stormy winds and waves of the seas beyond. Having so many enemies constantly in quest of them as a prey in their own element, no wonder that the flying-fish should be by nature a timid race, always taking to the air for protection, when threatened by an enemy in the sea. The approach of the porpoise, dolphin, albacore, and bonetta, quickly scare them from their watery haunts; but the terror produced by the latter is nothing in comparison to that excited by a huge ship suddenly plunging in among a shoal of them sunning themselves near the surface of the water, tumbling over and over in their hurried efforts to get up, or knocking each other down again into the sea in their haste to escape the fancied fangs of the nondescript monster that has thus unexpectedly invaded their domain. Strangers, on first seeing them, almost invariably take them for a flock of birds; and, indeed, when viewed at a little distance on the wing, it frequently requires a practised eye

47. The *Cyprinus* or *Carp*. The body elongated, almost round; the head with a small beak; the hinder part of the bone covering the gills, marked with a crescent; the fin covering the gills with three rays.¹¹

to detect the deception, a fresh flock of them being often made to start up at every plunge of the ship, when sailing through a part of the sea where they are rife. Mounting suddenly upwards, with a squatting noise like a flock of ducks, they now flicker away in a covey together, with astonishing speed, their long, thin, tapering wings quivering in rapid vibrations as they dart through the air, resembling the wings of the sparrow tribe. They appear to have as perfect self-command in the air as the water, the body of the flock always following the motions of the leaders, just as seen in a flock of birds, soaring up and sinking down, or wheeling to either hand, according as the pilots of the band vary their own onward flight. They fly by night as well as by day, although their power of vision in the former must be very defective, as is shown by their frequently dropping on board ship during the night, an accident which never happens to them during the day. Like most other fishes, they are attracted by a glare of light, and it is by taking advantage of this that they are allured in such numbers into the nets constructed for them on the Barbadoes coast, as to constitute no inconsiderable item in the food of the inhabitants of that island. Ships have sometimes followed a similar plan with singular success. H.M.S. *Prometheus*, in running down the trades, by nailing hammock-cloths along her sides, supported out by handspikes, and illumined by a row of pursers' lanterns between, caught as many nightly as gave a daily meal to all on board. They are sweet, delicate, and juicy eating, contrary to that of most of the other deep-sea fishes, which are harsh, dry, and tasteless. Their manner of cooking them in Barbadoes is by frying with a little lard and flour, dusting until brown and dry, and in this state exposing them for sale, every boat that visits a ship having generally large platters-full of them piled up in cross layers over each other, which always find abundance of eager customers, particularly after a long salt-beef cruise. Nor is the peculiar oratory, playful motions, and merry smirking faces of the jetty belles who vend them, the least interesting part of the scene; dancing nimbly about on some convenient boat plank, wagging their heads laughingly to and fro, and snapping their fingers in cadence to the tune they are humming, until attaining the object they had in view, of attracting the attention of some one to their wares, they now simper out, in their best boarding-school English, some such speech as the following: "Hye, buckra, do come buy him fine fish fo yam-chah! bady, what fo you no buy him all den off? I pop fo moe like a bottle o' pruce."—ED.

¹¹ The *Common Carp* in its general habits exhibits so great a degree of cunning, as to be sometimes called by the country people the River-fox. When attempted to be taken by a net, they will often leap over it; or immerse themselves so deep in the mud, as to suffer the net to pass over without touching them. They are also very shy of taking a bait; but, during spawning-time, so intent are they on the business of depositing their ova, that they will suffer themselves to be handled by any one who attempts it. They breed three or four times in the year, but their first spawning is in the beginning of May. Carp are found in the slow rivers and stagnant waters of Europe and Persia; and here principally in deep holes, under the roots of trees, hollow banks, or great beds of flags, &c. They do not often exceed four feet in length, and twenty pounds in weight; but

48. The *Cobitis* or *Loach*. The body oblong; almost equally broad throughout; the head small, a little elongated; the eyes in the hinder part of the head; the fin covering the gills from

Jovius mentions some caught in the Lago de Como, in Italy, that weighed two hundred pounds each, and others have been taken in the Dniester five feet in length.

The *Tench*, according to Artdedi, is a species of the carp, and is thick and bulky in proportion to its length. The colour of the back is dusky; the dorsal and ventral fins of the same colour; the head, sides, and belly, are of a greenish cast, most beautifully mixed with gold, which is in its greatest splendour when the fish is in highest season. They love still waters, and are rarely found in rivers; they are very foolish, and easily caught. This is one of those fish that prefer foul and weedy waters; and its haunts in rivers are chiefly amongst weeds, and in places well shaded with rushes. These fish thrive best in standing waters, where they lie under weeds near sluices and pond-heads. They are much more numerous in pools and pits than in rivers; but those taken in the latter are far preferable for the table. They begin to spawn in June, and may be found spawning in some waters till September. The best season is from that time till the end of May. These fish do not often exceed four or five pounds in weight. Mr. Pennant, however, mentions one that weighed ten pounds. Tench are in great repute with us as delicious and wholesome food; but in Guernsey they are considered bad fish, and in contempt called shoe-maker. Gessner even says, that it is insipid and unwholesome. Like the barbel, it was unnoticed by early writers; and Ausonius, by whom it was first mentioned, treats it with that disrespect which evinces the capriciousness of taste. These fish are sometimes found in waters where the mud is excessively fetid, and the weeds so thick that a hand-net can hardly be thrust down. In these situations they grow to a large size, and their exterior becomes completely tinged by the mud. Their flavour from this, if cooked immediately on being taken out, is often very unpleasant; but if they are transferred into clear water, they soon recover from the obnoxious taint. A tench was taken at Thornville-Royal in Yorkshire, in 1802, of such enormous size, and so singular in its shape, as rather to be accounted a *lusus nature* than a regular product. A piece of water which had been ordered to be filled up, and into which wood and rubbish had been thrown for some years, was directed to be cleared out. So little water remained, and in such quantity were the weeds and mud, that it was expected no fish would be found, except perhaps a few eels; but, greatly to the surprise of the persons employed, nearly two hundred brace of tench, and as many perch, were discovered. After the pond was supposed to be quite cleared, an animal was observed to be under some roots, which was conjectured to be an otter. The place was surrounded; and on making an opening, a tench was found of a most singular form, having literally taken the shape of the hole in which he had of course been many years confined. His length was four feet nine inches, his circumference two feet three inches, and his weight near twelve pounds. The colour was also singular, his belly being tinged with vermillion like that of a char. This extraordinary animal, after having been examined by many gentlemen, was carefully put into a pond. At first it merely floated, and after a while it swam gently away. When Mr. Daniel produced his 'Rural Sports' it was alive and well.

The *Chub*, which is also called the *cheven*, *nab*, or *botling*, very much resembles the carp, but is of a

four to six rays; the covers of the gills closed below.

49. The *Amia* or *Bonito*. The body round and slender; the head, forehead, and breast, without skin; the fin covering the gills with twelve rays; two beards from the nose.

50. The *Mormyrus*. The body oblong; the head elongated; the fin covering the gills with a single ray; the opening to the gills is linear, and has no bone covering them.

Such is the system of Mr. Gouan; by reducing to which any fish that offers, we can know its rank, its affinities, and partly its anatomy, all which make a considerable part in its natural history. But to show the use of this system still more apparently, suppose I meet with a fish, the name to me unknown, of which I desire to know something more. The way is first to see whether it be a cartilaginous fish, which may be known by its wanting fins to open and shut the gills, which the cartilaginous kinds are wholly without. If I find that it has them, then it is a spinous fish; and in order to know its kind, I examine its fins whether they be prickly or soft; I find them soft; it is therefore to be ranked among the soft-finned fishes. I then examine its ventral or belly fins, and finding that the fish has them, I look for their situation, and find they lie nearer to the tail than the pectoral fins. By this I find the animal to be a soft-finned abdominal fish. Then, to know which of the kinds of these fishes it is, I examine its figure and the shape of its head: I find the body rather oblong; the head with a small beak; the lower jaw like a saw; the fin covering the gills with eight rays. This animal must, therefore, be the herring, or one of that family, such as the pilchard, the sprat, the shad, or the anchovy. To give another instance:

longer form. The body is oblong, rather round, and is of an equal thickness in the greater part of the slope; the scales are large; the irides silvery; the cheeks of the same colour; the head and back of a deep dusky green; the sides silvery, but in the summer yellow; the belly white; the pectoral fins of a pale yellow; the ventral and anal fins red; and the tail forked, of a brownish hue, but tinged with blue at the end. It is altogether a handsome fish, but in no esteem for the table, being very coarse, and when out of season full of small hairy bones: the roe however is very good; and this fish stewed as carp will, it is said, deceive a connoisseur. Its name is derived from the shape of the head, *cop* being an old English word for head; and the French and Italians know it by a name synonymous with ours. The haunts of these fish are rivers whose bottoms are of sand or clay, or which are bounded by clayey banks, in deep holes, under hollow banks, shaded by trees or weeds. They are also found in the Esk, a river noted for the crystalline clearness of its waters, flowing over a rocky bottom. These fish often float on the surface, and are sometimes found in deep waters, where the currents are strong. In ponds fed by a rivulet they grow to a large size. They seldom, however, exceed the weight of four or five pounds, though Salvianus speaks of them as increasing to eight or nine. They deposit their spawn in April; and are in great perfection during the months of December and January. —Ed.

upon examining the fins of a fish to me unknown, I find them prickly; I then look for the situation of the ventral fins, I find them entirely wanting; this then must be a prickly-finned apodal fish. Of this kind there are but three: and by comparing the fish with the description, I find it either of the trichurus kind, the sword-fish, or the gilt-head. Upon examining also its internal structure, I shall find a very great similitude between my fish and that placed at the head of the family.

CHAP. II.

OF SPINOUS FISHES IN GENERAL.

HAVING given a method by which Spinous fishes may be distinguished from each other, the history of each in particular might naturally be expected to follow; but such a distinct account of each would be very disgusting, from the unavoidable uniformity of every description. The history of any one of this class very much resembles that of all the rest: they breathe air and water through the gills: they live by rapine, each devouring such animals as its mouth is capable of admitting; and they propagate, not by bringing forth their young alive, as in the cetaceous tribes, nor by distinct eggs, as in the generality of the cartilaginous tribes, but by spawn, or peas, as they are generally called, which they produce by hundreds of thousands. These are the leading marks that run through their whole history, and which have so much swelled books with tiresome repetition.

It will be sufficient therefore to draw this numerous class into one point of view, and to mark how they differ from the former classes; and what they possess peculiarly striking, so as to distinguish them from each other. The first object that presents itself, and that by which they differ from all others, are the bones. These, when examined but slightly, appear to be entirely solid; yet when viewed more closely, every bone will be found hollow, and filled with a substance less rancid and oily than marrow. These bones are very numerous, and pointed; and as in quadrupeds, are the props or stays to which the muscles are fixed which move the different parts of the body.

The number of bones in all spinous fishes of the same kind, is always the same. It is a vulgar way of speaking to say, that fishes are at some seasons more bony than at others: but this scarcely requires contradiction. It is true, indeed, that fish are at some seasons much fatter than at others: so that the quantity of the flesh being diminished, and that of the bones remaining the same, they appear to increase in number, as they actually bear a greater proportion.

All fish of the same kind, as was said, have the

same number of bones: the skeleton of a fish, however irregularly the bones may fall in our way at table, has its members very regularly disposed; and every bone has its fixed place; with as much precision as we find in the orders of a regular fabric. But then spinous fish differ in the number of bones according to the species; for some have a greater number of fins by which they move in the water. The number in each is always in proportion to the number and size of these fins; for every fish has a regular apparatus of bones and muscles by which the fins are moved; and all those fish, where they are numerous or large, must, of consequence, be considerably bony. Indeed, in the larger fish, the quantity of flesh is so much and the bones themselves are so large, that they are easily seen and separated; but in the smaller kinds with many fins, the bones are as numerous as in the great; yet being so very minute, they lurk almost in every part of the flesh, and are dangerous as well as troublesome to be eaten. In a word, those fish which are large, fat, and have few fins, are found to be the least bony; those which are small, lean, and have many fins, are the most bony of all others. Thus, for instance, a roach appears more bony than a carp, because it is leaner and smaller; and it is actually more bony than an eel, because it has a greater number of fins.

As the spinous fish partake less of the quadruped in their formation than any others, so they can bear to live out of their own element a shorter time. In general, when taken out of the water, they testify their change by panting more violently and at closer intervals, the thin air not furnishing their gills the proper play; and in a few minutes they expire. Some indeed are more vivacious in air than others; the eel will live several hours out of the water; and the carp has been known to be fattened in a damp cellar. The method is by placing it in a net well wrapped up in wet moss, the mouth only out, and then hung up in a vault. The fish is fed with white bread and milk; and the net now and then plunged into the water. The animal, thus managed, has been known not only to live for a fortnight, but to grow exceedingly fat, and of a superior flavour. From this it would seem that the want of moisture in the gills is the chief cause of the death of these animals; and could that be supplied, their lives might be prolonged in the air, almost as well as in their own element.

Yet it is impossible to account for the different operations of the same element, upon animals that, to appearance, have the same conformation. To some fishes, bred in the sea, fresh-water is immediate destruction: on the other hand, some fishes, that live in our lakes and ponds, cannot bear the salt water. Whence this difference can arise, is not easily to be accounted for. The saline quality of the water cannot properly be given as the cause; since no fishes imbibe any of

the sea's saltiness with their food, or in respiration. The flesh of all fishes is equally fresh, both in the river, and in the saltiest depths of the ocean; the salt of the element in which they live no way mixing with their constitution. Whence then is it that animals will live only there, and will quickly expire when carried into fresh-water? It may probably arise from the superior weight of the sea-water; as from the great quantity of salt dissolved in its composition, it is much heavier than fresh-water, so it is probable it lies with greater force upon the organs of respiration, and gives them their proper and necessary play: on the other hand, those fish which are used only to fresh-water, cannot bear the weight of the saline fluid, and expire in a manner suffocated in the grossness of the strange element.

But though there are some tribes that live only in the sea, and others only in fresh-water, yet there are some whose organs are equally adapted to either element; and that spend a part of their season in one, and a part in the other. Thus the salmon, the shad, the smelt, and the flounder, annually quit their native ocean, and come up our rivers to deposit their spawn. This seems the most important business of their lives; and there is no danger which they will not encounter, even to the surmounting precipices, to find a proper place for the deposition of their future offspring. The salmon, upon these occasions, is seen to ascend rivers five hundred miles from the sea; and to brave not only the danger of various enemies, but also to spring up cataraacts as high as a house. As soon as they come to the bottom of the torrent, they seem disappointed to meet the obstruction, and swim some paces back: they then take a view of the danger that lies before them, survey it motionless for some minutes, advance, and again retreat; till at last summoning up all their force, they take a leap from the bottom, their body straight, and strongly in motion; and thus most frequently clear every obstruction. It sometimes happens, however, that they want strength to make the leap; and then, in our fisheries, they are taken in their descent. But this is one of the smallest dangers that attend these adventuring animals in their progress: numberless are the methods of taking them; as well by the hook, as by nets, baskets, and other inventions, which it is not our business here to describe. Their capture makes, in several countries, a great article of commerce; and being cured in several different manners, either by salting, pickling, or drying, they are sent to all the markets of Europe.

As these mount up the rivers to deposit their spawn, others, particularly the eel, descend the fresh-water stream, as Redi assures us, to bring forth their young in the sea. About the month of August, annually, these animals take the opportunity of the most obscure nights, and when the rivers are flooded by accidental rains seek the ocean. When they have reached the sea,

and produced their young, for they are viviparous, they again ascend the stream, at different times, as opportunity offers, or as the season is favourable or tempestuous. Their passage begins usually about the end of January, and continues till towards the end of May, when they are taken in the river Arno by millions, and so small that a thousand of them goes to a pound. There is nothing more certain than that they descend our own rivers after floods in great abundance, and are thus caught in nets to very great advantage. They are possessed also of a power of climbing over any obstacle; for, by applying their glutinous and slimy bodies to the surface of the object they desire to surmount, they can thus creep up locks, weirs, and every thing that would prevent their ascending the current of the stream.¹

But the length of the voyage performed by these fishes, is short, if compared to what is annually undertaken by some tribes, that con-

¹ A writer in Loudon's Magazine of Natural History [vol. viii. p. 233] has the following observations on the migrations of the eel: "I have lived at different periods, and for many years, on the banks of the Tweed; and, since a bare-necked runagate at school, killing them in dozens with a table-fork purloined from the kitchen for a tiny spear, I have been convinced that they were the most numerous genus in the river, always excepting the minnows (*Cyprinus Phoxinus*); yet, for the greater part of these years, whence they came, or whither they went, was almost, if not altogether, a mystery, like the winter abode of the swallow before the time of Pennant and White. I had, indeed, heard stories of swarms of young eels having been observed entering the Esk, at Musselburgh, but these we never saw in the Tweed. In this river, although it is probably better stocked with trouts than any other river in Scotland, yet, as I have already said, I am convinced the eels are still more numerous: but the latter are not good, having far more of the peculiar fishy, or, rather eely taste than those got at Linlithgow, or in the Leven, as they descend from the loch of that name, the only eel fisheries in Scotland. I have now ascertained that swarms of young eels (that is, the fry of the eel) regularly enter the mouths of most of the rivers in the north: several fishers have informed me that they do so in the Ness, the Beaul, and the Conon. In the latter river, they begin to run up about the 20th of May; a few days sooner or later according to the season, or, mayhap, some other circumstances; and their appearance is always the forerunner of the ascent of the grilse. The time at which the eels descend the river in autumn (which, no doubt, they regularly do) does not seem to have been observed. When they enter the river, it is in a slender column of about 1½ ft. or 2 ft. wide, along the very edge of the stream; and so close together that a yard in length will contain many hundreds of them. After that they seem to separate, probably as they get stronger, or more accustomed to the fresh-water. It is not a little curious that they do not appear to be preyed upon by the gulls, or any other piscivorous bird. The column has neither forerunners nor stragglers, and passes usually in the course of three days. The eels are of about the thickness of a crow-quill, and the column of them has been traced unbroken, from the tideway, for about four miles up the river, to the junction of the Raasay, or Blackwater, which joins the Conon from the north-west."—Ed.

stantly reside in the ocean. These are known to take a course three or four thousand miles in a season, serving for prey to whales, sharks, and the numerous flocks of water-fowl, that regularly wait to intercept their progress. These may be called fish of passage, and bear a strong analogy to birds of passage, both from their social disposition, and the immensity of their numbers. Of this kind are the cod, the haddock, the whiting, the mackerel, the tunny, the herring, and the pilchard. Other fish live in our vicinity, and reside on our coasts all the year round; or keep in the depths of the ocean, and are but seldom seen: but these, at stated seasons, visit their accustomed haunts with regular certainty, generally returning the same week in the succeeding year, and often the same day.

The stated returns, and the regular progress of these fish of passage, is one of the most extraordinary circumstances in all the history of nature. What it is that impels them to such distant voyages; what directs their passage; what supports them by the way; and what sometimes prompts them to quit, for several seasons, one shore for another, and then return to their accustomed harbour; are questions that curiosity may ask, but philosophy can hardly resolve. We must dismiss inquiry, satisfied with the certainty of the facts.

The cod seems to be the foremost of this wandering tribe, and is only found in our northern part of the world. This animal's chief place of resort is on the banks of Newfoundland, and the other sand-banks that lie off Cape Breton. That extensive flat seems to be no other than the broad top of a sea-mountain, extending for above five hundred miles long, and surrounded with a deeper sea. Hither the cod annually repair in numbers beyond the power of calculation, to feed on the quantity of worms that are to be found there in the sandy bottom. Here they are taken in such quantities, that they supply all Europe with a considerable share of provision. The English have stages erected all along the shore for salting and drying them; and the fishermen, who take them with the hook and line, which is their method, draw them in as fast as they can throw out. This immense capture, however, makes but a very small diminution, when compared to their numbers; and when their provision there is exhausted, or the season for propagation returns, they go off to the polar seas, where they deposit their roes in full security. From thence want of food forces them, as soon as the first more southern seas are open, to repair southward for subsistence. Nor is this fish an unfrequent visitant upon our own shores: but the returns are not so regular, nor does the capture bear any proportion to that at Newfoundland.²

The haddock, the whiting, and the mackerel,

² See Supplementary Note A, p. 300.

are thought by some to be driven upon our coasts rather by their fears than their appetites; and it is to the pursuit of the larger fishes that we owe their welcome visits.³ It is much more probable, that they come for that food which is found in more plenty near the shore than farther out at sea. One thing is remarkable, that their migrations seem to be regularly conducted. The grand shoal of haddocks that comes periodically on the Yorkshire coasts, appeared there in a body on the 10th of December, 1766; and exactly on the same day in the following year. This shoal extended from the shore near three miles in breadth, and in length for more than forty. The limits of a shoal are precisely known; for if the fishermen put down their lines at the distance of more than three miles from shore, they catch nothing but dog-fish: a proof that the haddock is not there.

But of all migrating fish, the herring and the pilchard take the most adventurous voyages. Herrings are found in the greatest abundance in the highest northern latitudes. In those inaccessible seas, that are covered with ice for a great part of the year, the herring and pilchard find a quiet and sure retreat from all their numerous enemies; thither neither man, nor their still more destructive enemy, the fin-fish, or the cachalot, dares to pursue them. The quantity of insect food which those seas supply, is very great; whence, in that remote situation, defended by the icy rigour of the climate, they live at ease, and multiply beyond expression. From this most desirable retreat, Anderson supposes they would never depart, but that their numbers render it necessary for them to migrate; and, as with bees from a hive, they are compelled to seek for other retreats.

For this reason, the great colony is seen to set out from the icy sea about the middle of winter; composed of numbers, that if all the men in the world were to be loaded with herrings, they would not carry the thousandth part away. But they no sooner leave their retreats, but millions of enemies appear to thin their squadrons. The fin-fish and the cachalot swallow barrels at a yawn; the porpoise, the grampus, the shark, and the whole numerous tribe of dog-fish, find them an easy prey, and desist from making war upon each other; but, still more, the unnumbered flocks of sea-fowl, that chiefly inhabit near the pole, watch the outset of their dangerous migration, and spread extensive ruin.

In this exigence the defenceless emigrants find no other safety but by crowding closer together, and leaving to the outmost bands the danger of being first devoured; thus, like sheep when frightened, that always run together in a body, and each finding some protection in being but one of many that are equally liable to invasion, they are seen to separate into shoals, one body of

which moves to the west, and pours down along the coasts of America, as far south as Carolina, and but seldom farther. In Chesapeake bay, the annual inundation of these fish is so great, that they cover the shores in such quantities as to become a nuisance. Those that hold more to the east, and come down towards Europe, endeavour to save themselves from their merciless pursuers, by approaching the first shore they can find; and that which first offers in their descent, is the coast of Iceland, in the beginning of March. Upon their arrival on that coast, their phalanx, which has already suffered considerable diminutions, is, nevertheless, of amazing extent, depth, and closeness, covering an extent of shore as large as the island itself. The whole water seems alive; and is seen so black with them to a great distance, that the number seems inexhaustible. There the porpoise and the shark continue their depredations; and the birds devour what quantities they please. By these enemies the herrings are cooped up into so close a body, that a shovel, or any hollow vessel, put into the water, takes them up without farther trouble.

That body which comes upon our coasts, begins to appear off the Shetland isles in April. These are the forerunners of the grand shoal which descends in June; while its arrival is easily announced, by the number of its greedy attendants, the gannet, the gull, the shark, and the porpoise. When the main body is arrived, its breadth and depth is such as to alter the very appearance of the ocean. It is divided into distinct columns, of five or six miles in length, and three or four broad; while the water before them curls up, as if forced out of its bed. Sometimes they sink for the space of ten or fifteen minutes, then rise again to the surface; and, in bright weather, reflect a variety of splendid colours, like a field bespangled with purple, gold, and azure. The fishermen are ready prepared to give them a proper reception; and, by nets made for the occasion, they take sometimes above two thousand barrels at a single draught.

From the Shetland isles, another body of this great army, where it divides, goes off to the western coasts of Ireland, where they meet with a second necessity of dividing. The one takes to the Atlantic, where it is soon lost in that extensive ocean; the other passes into the Irish sea, and furnishes a very considerable capture to the natives.

In this manner the herrings, expelled from their native seas, seek those bays and shores where they can find food, and the best defence against their unmerciful pursuers of the deep. In general, the most inhabited shores are the places where the larger animals of the deep are least fond of pursuing; and these are chosen by the herrings as an asylum from greater dangers. Thus, along the coasts of Norway, the German shores, and the northern shores of France, these animals are found punctual in their visitations.

³ See Supplementary Note B, p. 301.

In these different places they produce their young; which, when come to some degree of maturity, attend the general motions. After the destruction of such numbers, the quantity that attempts to return is but small; and Anderson doubts whether they ever return.

Such is the account given of the migration of these fishes, by one who, of all others, was best acquainted with their history, and yet many doubts arise, in every part of the migration. The most obvious which has been made is, that though such numbers perish in their descent from the north, yet, in comparison to those that survive, the account is trifling: and it is supposed, that of those taken by man, the proportion is not one to a million. Their regularly leaving the shore also at a stated time, would imply that they are not in these visits under the impulse of necessity. In fact, there seems one circumstance that shows these animals governed by a choice with respect to the shores they pitch upon; and not blindly drove from one shore to another. What I mean, is their fixing upon some shores for several seasons, or, indeed, for several ages together; and, after having regularly visited them every year, then capriciously forsaking them, never more to return. The first great bank for herrings was along the shores of Norway. Before the year 1584, the number of ships from all parts of Europe that resorted to that shore exceeded some thousands. The quantity of herrings that were then assembled there was such, that a man who should put a spear in the water, as Olaus Magnus asserts, would see it stand on end, being prevented from falling. But soon after that period, these animals were seen to desert the Norway shores, and took up along the German coast, where the Hanse-towns drove a very great trade by their capture and sale; but, for above a century, the herrings have in a great measure forsaken them; and their greatest colonies are seen in the British channel, and upon the Irish shores. It is not easy to assign a cause for this seemingly capricious desertion: whether the number of their finny enemies, increasing along the northern coasts, may have terrified the herring tribe from their former places of resort; or, whether the quantity of food being greater in the British channel, may not allure them thither; is not easy to determine.⁴

The pilchard, which is a fish differing little from the herring, makes the coast of Cornwall its place of principal resort. Their arrival on that coast is soon proclaimed by their attendants the birds and the larger fishes; and the whole country prepare to take the advantage of this treasure, providentially thrown before them. The natives sometimes enclose a bay of several miles extent with their nets called *saines*. To direct them in their operations, there were some years ago (but I believe they are discontinued) several men

placed on eminences near the shore, called *huers*, who, with brooms in their hands, gave signals where the nets were to be extended, and where the shoals of fishes lay: this they perceived by the colour of the water, which assumed a tincture from the shoals beneath. By these means, they sometimes take twelve or fifteen hundred barrels of pilchards at a draught; and they place them in heaps upon the shore.—It often happens that the quantity caught exceeds the salt or the utensils for curing them; and they then are carried off to serve for the purposes of manure. This fishery employs not only great numbers of men at sea, training them to naval affairs, but also numbers of women and children at land, in salting and curing the fish; in making boats, nets, ropes, and casks, for the purposes of taking or fitting them for sale. The poor are fed with the superfluity of the capture; the land is manured with the offals; the merchant finds the gain of commission, and honest commerce; the fisherman a comfortable subsistence from his toil. "Ships," says Dr. Borlase, "are often freighted hither with salt, and into foreign countries with the fish, carrying off at the same time a part of our tin. The usual produce of the number of hogsheads exported for ten years, from 1747 to 1756 inclusive, amounted to nearly thirty thousand hogsheads each year; every hogshead has amounted, upon an average, to the price of one pound thirteen shillings and threepence. Thus the money paid for pilchards exported, has annually amounted to near fifty thousand pounds."

Whence these infinite numbers are derived, still remains obscure; but it will increase our wonder to be told, that so small a fish as the stickleback, which is seldom above two inches long, and that one would think could easily find support in any water, is yet obliged to colonize, and leave its native fens in search of new habitations. Once every seventh or eighth year, amazing shoals of these appear in the river Welland, near Spalding, and come up the stream, forming one great column. They are supposed to be multitudes collected in some of the fens, till overcharged with numbers, they are periodically obliged to migrate. An idea may be had of their numbers, when we are informed, that a man, employed by a farmer to take them, for the purpose of manuring his grounds, has got, for a considerable time, four shillings a-day by selling them at a halfpenny a bushel!

Thus we see the amazing propagation of fishes along our own coasts and rivers; but their numbers bear no proportion to the vast quantities found among the islands of the Indian ocean. The inhabitants of these countries are not under the necessity even of providing instruments for fishing; it is but going down to the shore, and there the fish are found in great numbers in the plashes that still continue to have water in them. In some of these places the quantity is so great that they are left in shoals on those swamps,

⁴ See Supplementary Note C, p. 303.

dried up by the sun, and their putrefaction contributes to render the country unhealthy.

This power of increasing in these animals, exceeds our ideas, as it would in a very short time outstrip all calculation. A single herring, if suffered to multiply unmolested and undiminished for twenty years, would show a progeny greater in bulk than ten such globes as that we live on. But happily the balance of Nature is exactly preserved; and their consumption is equal to their fecundity. For this reason we are to consider the porpoise, the shark, or the cod-fish, not in the light of plunderers and rivals, but of benefactors to mankind. Without their assistance, the sea would soon become overcharged with the burden of its own productions; and that element, which at present distributes health and plenty to the shore, would but load it with putrefaction.

In the propagation of all fish, some degree of warmth seems absolutely necessary, not only to their preservation, but to the advancement of their posterity. Their spawn is always deposited in those places where the sunbeams may reach them, either at the bottom of shallow shores, or floating on the surface in deeper waters. A small degree of heat answers all the purposes of incubation, and the animal issues from the egg in its state of perfect formation, never to undergo any succeeding change.

Yet, still I have some doubts whether most fish come from the egg completely formed. We know that in all the frog tribe, and many of the lizard kind, they are produced from the egg in an imperfect form. The tadpole, or young frog, with its enormous head and slender tail, is well known; a species of the lizard also, which is excluded from the shell without legs, only acquires them by degrees, and not till after some time does it put off its serpent form. It is probable that some kinds of fish in like manner suffer a change; and though it be too inconsiderable to strike the fisherman or the inattentive spectator, yet it makes a very material difference to the naturalist, and would, perhaps, disarrange his most favourite systems. A slight alteration in the fins or bones that cover the gills would overturn the whole fabric of the most applauded ichthyologist; and yet, as I observed, it is most probable that these minute alterations often take place.

As a proof of this, during the month of July, there appear near Greenwich, innumerable shoals of small fishes, which are known to the Londoners by the name of White bait. It is universally agreed that they are the young of some fish; they are never seen but at this time of the year, and never found to have any roe, a circumstance that proves their not being come to maturity. The quantity is amazing; and the fish that produces them in such numbers must be in plenty, though it is not yet known what that fish is, as they correspond with no other species whatever.

They most resemble the smelt in form; and yet they want a fin which that animal is never without. They cannot be the bleak, as they are never found in other rivers where the bleak breed in great abundance. It is most probable, therefore, that they are the young of some animal not yet come to their perfect form, and therefore reducible to no present system.⁵

The time that spinous fishes continue in the pea is in proportion to the size of the kind. It is a rule that chiefly holds through nature, that the larger the animals are, the longer they continue before exclusion. This I say holds generally through all nature, though it is not easy to assign a cause for so well known a truth. It may probably be, that as all large bodies take a longer time to grow hot than small ones, so the larger the egg, the longer influence of vital warmth it requires to reach through all its recesses, and to unfold the dormant springs that wait to be put into motion.

The manner in which the eggs of fishes are impregnated is wholly unknown. All that obviously offers is, that in ponds the sexes are often seen together among the long grass at the edge of the water; that there they seem to struggle; and that during this time they are in a state of suffering; they grow thin; they lose their appetite, and their flesh becomes flabby; the scales of some grow rough, and they lose their lustre. On the contrary, when the time of coupling is over, their appetite returns; they reassume their natural agility, and their scales become brilliant and beautiful.

Although the usual way with spinous fishes is to produce by spawn; yet there are some, such as the eel and the blenny, that are known to bring forth their young alive. Bowlker, who has written a treatise upon fishing, seems to determine the question relative to the viviparous production of eels, upon the authority of one or two credible witnesses. An eel, opened in the presence of several persons of credit, was found to have an infinite number of little creatures, closely wrapped up together in a lump, about the size of a nutmeg, which being put into a basin of water, soon separated, and swam about: yet still, whether these may not have been worms generated in the animal's body, remains a doubt; for there are scarcely any fishes that are not infested with worms in that manner.

With respect to the growth of fishes, it is observed, that among carps, particularly the first year, they grow to about the size of the leaf of a willow-tree; at two years they are about four inches long. They grow but one inch more the third season, which is five inches. Those of four years old are about six inches; and seven after the fifth. From that to eight years old they are found to be large in proportion to the goodness of the pond, from eight to twelve inches. With

⁵ See Supplementary Note D, p. 304.

regard to sea-fish, the fishermen assure us, that a fish must be six years old before it is fit to be served up to table. They instance it in the growth of a mackerel. They assure us that those of a year old are as large as one's finger; that those of two years are about twice that length; at three and four years, they are that small kind of mackerel that have neither milts nor roes; and between five and six, they are those full-grown fish that are served up to our tables. In the same manner, with regard to flat-fishes, they tell us, that the turbot and barbel at one year are about the size of a crown-piece; the second year, as large as the palm of one's hand; and at the fifth and sixth year, they are large enough to be served up to table. Thus it appears, that fish are a considerable time in coming to their full growth, and that they are a long time destroyed before it comes to their turn to be destroyers.⁶

All fish live upon each other in some state of their existence. Those with the largest mouths attack and devour the larger kinds; those whose mouths are less, lie in wait for the smaller fry; and even these chiefly subsist upon spawn. Of those which live in the ocean, of the spinous kinds, the dorado is the most voracious. This is chiefly found in the tropical climates; and is at once the most active and the most beautiful of the finny region. It is about six feet long; the back all over enamelled with spots of a bluish green and silver; the tail and fins of a gold colour; and all have a brilliancy of tint, that nothing but nature's pencil can attain to: the eyes are placed on each side of the head, large and beautiful, surrounded with circles of shining gold. In the seas where they are found, these fish are always in motion, and play round ships in full sail with ease and security: for ever either pursuing or pursued, they are seen continually in a state of warfare; either defending themselves against the shark, or darting after the smaller fishes. Of all others, the Flying-fish most abounds in these seas; and as it is a small animal, seldom growing above the size of a hering, it is chiefly sought by the dorado. Nature has furnished each respectively with the powers of pursuit and evasion. The dorado being above six feet long, yet not thicker than a salmon, and furnished with a full complement of fins, cuts its way through the water with amazing rapidity: on the other hand, the flying-fish is furnished with two pair of fins longer than the body, and these also moved by a stronger set of muscles than any other. This equality of power seems to furnish one of the most entertaining spectacles those seas can exhibit. The efforts to seize on the one side, and the arts of escaping on the other, are perfectly amusing. The dorado is seen, upon this occasion, darting after its prey,

which will not leave the water, while it has the advantage of swimming, in the beginning of the chase. But, like a hunted hare, being tired at last, it then has recourse to another expedient for safety by flight. The long fins, which began to grow useless in the water, are now exerted in a different manner, and different direction, to that in which they were employed in swimming: by this means, the timid little animal rises from the water, and flutters over its surface for two or three hundred yards, till the muscles employed in moving the wings are enfeebled by that particular manner of exertion. By this time, however, they have acquired a fresh power of renewing their efforts in the water, and the animal is capable of proceeding with some velocity by swimming: still, however, the active enemy keeps it in view, and drives it again from the deep; till, at length, the poor little creature is seen to dart to shorter distances, to flutter with greater effort, and to drop down at last into the mouth of its fierce pursuer. But not the dorado alone, all animated nature seems combined against this little fish, which seems possessed of double powers, only to be subject to greater dangers. For though it should escape from its enemies of the deep, yet the tropic bird and the albatross are for ever upon the wing to seize it. Thus pursued in either element, it sometimes seeks refuge from a new enemy; and it is not unfrequent for whole shoals of them to fall on ship-board, where they furnish man with an object of useless curiosity.

The warfare in fresh water is not carried on with such destructive activity; nor are the inhabitants of that element so numerous. It would seem that there is something more favourable to the fecundity of fishes in the ocean than in an element less impregnated with salt. It has been the opinion of some philosophers that all fish are natives of that great reservoir; and that only colonies have been sent up rivers, either through accident, or the necessity of procuring subsistence. They have been led to this opinion by the superior fecundity of sea-fish, which breed twenty to one; as well as by their superiority in strength and size, over those of the same kind found in lakes and rivers. This is a matter too remotely speculative to be worth pursuing; but certain it is that, in fresh water, fishes seem to abate much of their courage and rapacity; pursue each other with less violence, and seem to be less powerfully actuated by all their appetites. The greediness with which sea-fish devour the bait is prodigious, if compared with the manner they take it in fresh water. The lines of such fishermen as go off to sea are coarse, thick, and clumsy, compared to what are used by those who fish at land. Their baits are seldom more than a piece of a fish, or the flesh of some quadruped, stuck on the hook in a bungling manner; and scarcely any art is employed to conceal the deception. But it is otherwise in fresh water: the lines must often be

⁶ *Traite des Peches*, par Monsieur Duhamel. Sect. 3, p. 100.

drawn to a hair-like fineness; they must be tinted of the peculiar colour of the stream; the bait must be formed with the nicest art, and even, if possible, to exceed the perfection of nature: yet still the fishes approach it with diffidence, and often swim round it with disdain. The cod, on the banks of Newfoundland, the instant the hook, baited only with the guts of the animal last taken, is dropped into the water, darts to it at once, and the fishermen have but to pull up as fast as they throw down. But it is otherwise with those who fish in fresh waters, they must wait whole hours in fruitless expectation; and the *patience of a fisherman* is proverbial among us.

This comparative neglect of food, which is found in all the tribes of fresh-water fishes, renders them less turbulent and less destructive among each other. Of all these the pike is the most active and voracious; and our poets, whose business it is to observe the surface of nature, have called it the tyrant of the watery plain. In fact, in proportion to its strength and celerity, the pike does some mischief; but what are its effects compared to those of the cachalot or the shark! they resemble the petty depredations of a robber, put in competition with the ravages of a conqueror! However, the pike will attack every fish less than itself; and it is sometimes seen choked, by attempting to swallow such as are too large a morsel. It is immaterial of what species the animal it pursues appears to be, whether of another or its own, all are indiscriminately devoured; so that every fish owes its safety to its minuteness, its celerity, or its courage; nor does the pike confine itself to feed on fish and frogs; it will draw down the water-rat and the young ducks, as they are swimming about. Gesner tells us of a mule that stooped to drink in the water, when a famished pike, that was near, seized it by the nose, nor was it disengaged till the beast flung it on shore. So great is their rapacity, that they will contend with the otter for his prey, and even endeavour to force it from him. For this reason it is dreaded by all other fish: and the small ones show the same uneasiness and detestation at the presence of their tyrant, as the little birds do at the sight of a hawk or an owl. When the pike lies asleep near the surface, as is frequently the case, the lesser fish are often observed to swim around it in vast numbers, with a mixture of caution and terror.

The other tribes of fresh-water fish are much inferior to this animal in courage and rapacity: they chiefly subsist upon worms and insects, pursuing them at the bottom, or jumping after them to the surface of the water. In winter also, their appetite seems entirely to forsake them; at least they continue in so torpid a state, that few baits will tempt them to their destruction. At that season, they forsake the shallow waters, and seek those deep holes to be found in every river, where they continue for days together, without ever ap-

pearing to move. The cold seems to affect them; for at that time they lie close to the bottom, where the water is most warm, and seldom venture out, except the day be peculiarly fine, and the shallows at the edges of the stream become tepidified by the powerful rays of the sun. Indeed, I have been assured, that some fishes may be rendered so torpid by the cold, in the northern rivers, as to be frozen up in the great masses of ice, in which they continue for several months together, seemingly without life or sensation, the prisoners of congelation, and waiting the approach of a warmer sun to restore them at once to life and liberty. Thus that cheerful luminary not only distributes health and vegetation to the productions of the earth, but is ardently sought by even the gelid inhabitants of the water.

As fish are enemies one to another, so each species is infested with worms of different kinds peculiar to itself. The great fish abound with them; and the little ones are not entirely free. These troublesome vermin lodge themselves either in the jaws and the intestines internally, or near the fins without. When fish are healthy and fat they are not much annoyed by them; but in winter, when they are lean or sickly, they then suffer very much.

Nor does the reputed longevity of this class secure them from their peculiar disorders. They are not only affected by too much cold, but there are frequently certain dispositions of the element in which they reside unfavourable to their health and propagation. Some ponds they will not breed in, however artfully disposed for supplying them with fresh recruits of water, as well as provision. In some seasons they are found to feel epidemic disorders, and are seen dead by the water-side, without any apparent cause: yet still they are animals of all others the most vivacious, and they often live and subsist on such substances, as are poisonous to the more perfect classes of animated nature.

It is not easy to determine whether the poisonous qualities which many of them are found to possess, either when they wound our bodies externally with their spines, or when they are unwarily eaten at our tables, arises from this cause. That numbers of fishes inflict poisonous wounds, in the opinion of many, cannot be doubted. The concurrent testimony of mankind they think sufficient to contradict any reasonings upon this head, taken from anatomical inspection. The great pain that is felt from the sting given by the back fin of the weaver, bears no proportion to the smallness of the instrument that inflicts the wound. How the poison is preserved, or how it is conveyed by the animal, it is not in our power to perceive; but its actual existence has been often attested by painful experience. In this instance we must decline conjecture, satisfied with history.

The fact of their being poisonous when eaten, is equally notorious; and the cause equally in-

scrutable. My poor worthy friend, Dr. Grainger, who resided for many years at St. Christopher's, assured me, that of the fish caught, of the same kind, at one end of the island, some were the best and most wholesome in the world; while others taken at a different end were always dangerous, and most commonly fatal. We have a paper in the Philosophical Transactions, giving an account of the poisonous qualities of those found at New Providence, one of the Bahama islands. The author assures us, that the greatest part of the fish of that dreary coast are all of a deadly nature: their smallest effects being to bring on a terrible pain in the joints, which, if terminating favourably, leaves the patient without any appetite for several days after. It is not those of the most deformed figure, or the most frightful to look at, that are alone to be dreaded; all kinds, at different times, are alike dangerous; and the same species which has this day served for nourishment, is the next, if tried, found to be fatal!

This noxious quality has given rise to much speculation, and many conjectures. Some have supposed it to arise from the fishes on these shores eating of the manchineel apple, a deadly vegetable poison, that sometimes grows pendent over the sea: but the quantity of those trees growing in this manner, bears no proportion to the extensive infection of the fish. Labat has ascribed it to their eating the galley-fish, which is itself most potently poisonous: but this only removes our wonder a little farther back: for it may be asked, with as just a cause for curiosity, how comes the galley-fish itself to procure its noxious qualities? Others have ascribed the poison of these fishes to their feeding upon copperas-beds: but I do not know of any copper mines found in America. In short, as we cannot describe the alembic by which the rattlesnake distils its malignity, nor the process by which the scorpion, that lives among roses, converts their sweets to venom, so we cannot discover the manner by which fishes become thus dangerous; and it is well for us of Europe that we can thus wonder in security. It is certain that with us, if fishes, such as carp or tench, acquire any disagreeable flavour from the lakes in which they have been bred, this can be removed, by their being kept some time in finer and better water: there they soon clear away all those disagreeable qualities their flesh had contracted, and become as delicate as if they had been always fed in the most cleanly manner. But this expedient is with us rather the precaution of luxury than the effect of fear: we have nothing to dread from the noxious qualities of our fish; for all the animals our waters furnish are wholesome.

Happy England! where the sea furnishes an abundant and luxurious repast, and the fresh waters an innocent and harmless pastime; where the angler, in cheerful solitude, strolls by the edge of the stream, and fears neither the coiled

snake, nor the lurking crocodile; where he can retire at night, with his few trouts (to borrow the pretty description of old Walton) to some friendly cottage, where the landlady is good, and the daughter innocent and beautiful; where the room is cleanly, with lavender in the sheets, and twenty ballads stuck about the wall! There he can enjoy the company of a talkative brother sportsman, have his trouts dressed for supper, tell tales, sing old tunes, or make a catch! There he can talk of the wonders of nature with learned admiration, or find some harmless sport to content him, and pass away a little time, without offence to God, or injury to man!

NOTE A.—*The Newfoundland Cod-fishery.*

The Newfoundland cod-fishery is on the banks, at different distances from the island. The chief is that called the Great bank, which lies between 41° and 49° N. lat., and is in length 300 miles and in breadth 75 miles; but some assign to it a length of more than 400 miles, and a breadth of about 140. It has from 22 to 50 fathoms water. Vert, or Green bank, is not much inferior to the Great bank in dimensions, being 240 miles long and 120 wide; and Banquero is not much less. Besides these, there are many other shoals abounding with fish. The fishery near the shore commences earlier, and continues longer, than that upon the banks, but is not nearly so productive. The shore-fishery begins about the 20th of April; the fishery upon the bank on the 10th of May. The former continues till the 10th of October; while the latter concludes about the end of September. Different baits are used at different periods of the season. The first is a piece of pork, or of bird flesh. The cod when caught, furnishes bait to continue the fishing, the shell-fish called clams, which are found in the belly of the cod, being excellent for that purpose. To the clam succeeds the lobster; and to the lobster, the herring and lance; which, in June, are succeeded by the capelan, a fish which then makes its appearance upon the coast. The capelan is, in August, displaced by the squid; which again makes way for the herring. The cod is not taken with a net but with hooks, and only during daylight. An expert fisher will take from 150 to upwards of 300 in a day. A single fisher has in one season caught 12,000 fish; but the average number is 7,000. "When the boats are stationed on the fishing-ground, the men sit or stand at equal distances from the gunwales, and each attends to his own lines. So abundant are the fish at times, that a couple of cod are hooked on each line before the lead reaches the bottom; and while the one line is running out, the fisherman has only to turn round and pull in the other, with a fish on each hook. In this way they fill the boat in a very short time. If the cod be very large, it is lifted into the boat, as soon as it comes to the water's edge, by a strong iron hook fixed on the end of a short pole called a gaff. As soon as the boat is loaded, they proceed to the stage on the shore with the fish, when the operations of splitting and salting succeed. Fish should be brought to the shore within forty-eight hours at farthest after it is caught. A splitter who has acquired dexterity, will, in an hour, split 300 quintals of fish; but the common quantity is 200 quintals. When the fish has been dried, and laid in heaps, a heap 20 feet in length by 10 in breadth, is supposed to contain 300 quintals; and if it be permitted to lie two days, it decreases in bulk about one-twelfth. The fish caught at the beginning of the season are reckoned

the best. The best method of curing is by drying them, and this way is most generally practised; but, in some cases, they are salted in bulk in the hold, and are thus carried to market. Some ships, instead of stopping to fish, proceed directly to the island, where they purchase a cargo from the inhabitants; but by far the greater number catch and cure a cargo for themselves. The former are called sack-ships, the latter fishing-ships. The fish are sold in every part of the world, but the principal markets are the West Indies, Spain, Portugal, and Italy. The shipping belonging to this colony, employed in the fishery, amounted in 1812, to 495 vessels admeasuring 61,543 tons, and navigated by 4,950 seamen; besides 2,000 fish-shallops, measuring about 20,000 tons, and manned by 6,000 men. But Mr. Macgregor states that, in 1832, not more than 8 or 10 British vessels were employed in the Bank fishery. "It would not be easy," says a late writer, "to give a correct idea of a Newfoundland fishing-village. Village! the word calls up visions of quiet hamlets embosomed in trees. We see cottages, each with its little garden, from which floats upward a scent of wallflowers and stocks. The women are working at their open doors; the children are rolling on the green, or sailing their boats in the willow-shaded pond, or swinging in the old elm near the church. The church itself is half-hidden by two or three dark yew-trees, that throw deep shadows over the daisied graves about them; and there is a winding walk that leads to the very gate of the pretty parsonage. The old manor-house is near, with its noisy rookery and its rich woods, from whose shades flows forth all day a stream of merry song; and far away are yet stately mansions and broader parks. Far other is the scene presented by a so-called village on the coast of Newfoundland. A few low wooden huts perched here and there among the rocks, with a rude path of communication between them; a small plain church, also of wood; and a building, generally of more pretensions, surmounted by a small cross, the Roman Catholic chapel; such are its component parts. No flowers; no gardens, save here and there a patch of potatoes; no parsonage, for a clergyman comes from a distance to perform divine service on a Sunday. Tier above tier along the coast, supported by fir-poles fixed in the rock, are the stages on which the salted fish is spread to dry. The scent rising from these is an antidote to all romance. The 'breath of the sweet south,' blowing fresh from the waters, passes over the 'cod-flakes,' and becomes tainted with the sickening odour. Even at a considerable distance from the shore the same annoyance is felt, poisoning the pure air of heaven. There are other horrors of a similar description connected with the fisheries, but I pass them by with a shudder. The bare-footed children, lying among the stones, raise their unwashed faces to watch the stranger with looks of stupid wonder. The women, if it be summer, sit basking in the sun; few, alas! great as the need may be, with needle in hand. Their talk is of seals and cod-fish, of *hauling* and *jigging*; and their jargon generally betrays an Irish origin. All this is little cheerful, but there is a sadness induced by the silence of Nature in the scenery of Newfoundland, that none that have not felt it can understand. You may pause again and again as you wander among the stunted woods, and strain your ears to hear the voice of a bird, the hum of an insect, in vain. All is lonely and desolate, yourself the only living, breathing creature far as the sight can reach. The continuous murmur of life and joy that fills the summer air of our own country is unknown there. The wind cannot 'shake music from the boughs' of the stunted fir-trees. Here and there a stream bounding along the rocky bed, or a stray ouzel, with its poor chirping, may strive to break the melancholy spell; but the general aspect of Nature is mournful, and

where beauty exists it is as the beauty of a statue—cold, and voiceless, and dead."

NOTE B.—*The Mackerel and Thunny fisheries.*

The common mackerel belongs to the tribe *Scomberoides*, which includes the thunny and the bonito, the fishery of which employs much capital and many hands. The general form of the mackerel is too well known to require particular description. Its colours are particularly brilliant; a fine steel blue on the back, changing into golden green and purple, and waved with black lines to a little below the lateral line. The under part of the body is of a silvery white, with purple and golden reflexions. It has no swimming vessel.

It is generally believed that the mackerel is a migratory fish. Next to the herring, it affords the most abundant and lucrative fishery in the seas which wash the north-west of Europe. The route which Anderson has traced of the migrations of the mackerel is well known. This fish (says he) passes the winter in the north; towards the spring the great shoal coasts along Iceland, Scotland, and Ireland, and throws itself into the Atlantic Ocean, where one column, in passing along Portugal and Spain, enters the Mediterranean. The other column enters La Manche, appears in May on the coasts of France and England, and passing from thence is found on the shores of Holland and Friesland in June. This second column, having arrived in July on the coasts of Jutland, detaches a division, which, making the tour of this almost island, penetrates into the Baltic Sea, and the remainder, passing along Norway, returns to the North. But Mr. Anderson throws doubts upon a recital, in itself very improbable, when he adds, that the mackerel not being an object of commerce, and exciting but little attention, he could only obtain this information from two fishermen of Heligoland. Other fishermen, referred to by Duhamel as his authorities, relate that the mackerels pass the winter in the different bays of Newfoundland; that they bury themselves in the mud, where they remain till the end of May, when the melting of the ice permits them to appear in great numbers along the coasts, and when many are taken. At this time, however, they have, it is said, a taste of mud, and it is in July and August only that they are fat and well tasted.

Admiral Pleville-Lepley, who had his home on the ocean for half-a-century, communicated an observation to M. Lacépède, which seems to confirm this story. He assured him that at Greenland, in the small bays surrounded with rocks, so common on this coast, where the water is always calm and the bottom generally soft mud and fuci, he had seen in the beginning of spring myriads of mackerels with their heads sunk some inches in the mud, their tails elevated vertically above its level, and that this mass of fishes was such that at a distance it might be taken for a reef of rocks. The Admiral supposed that the mackerels had passed the winter torpid under the ice and snow; and added, that, for fifteen or twenty days after their revival, these fishes were affected with a kind of blindness, and that then many were taken by the net; but as they recovered their sight the net would not answer, and hooks and lines were used. Something similar to this is found in Schoenvelde's 'Ichthyology.' Certain seamen had related to this author, that at the end of autumn there grows over the eyes of the scombers a pellicle like a nail, which blinds them during winter, and which falls off or disappears in spring. This is said to be the reason that mackerels are earlier taken on the southern coasts, and that they are not fished in winter. It is not impossible, in point of fact, says Baron Cuvier, that the adipose skin which is narrowed before and behind the orbit of the mackerel, may take in winter

more breadth and thickness, and cover the greater part of the eye. But the sojourn of the mackerel in the creeks of Greenland, in a state of torpidity, is the more to be doubted, as Otho Fabricius, who lived so long in this country, does not even name the mackerel as one of the fishes of the coast.

Nearly all the species of mackerel are gregarious, and unite in immense shoals. Some of them are migratory, making long voyages at certain seasons of the year. It is believed that they are all eatable; and some of them are well known to be exceedingly delicate food. They afford employment and support to numerous fishermen in various countries of Europe. They are in the whole about twenty-five species. The mackerel, when alive, from the elegance of its shape, and the brilliancy of its colours, is one of the most beautiful fish that frequents our coasts. Death, in some measure, impairs the colours, but it by no means obliterates them.

It visits our shores in vast shoals; but, from being very tender and unfit for long carriage, is found less useful than other gregarious fish. In some places it is taken by lines from boats, as during a fresh gale of wind it readily seizes a bait.* It is necessary that the boat should be in motion, in order to drag the bait along (a bit of red cloth, or a piece of the tail of a mackerel) near the surface of the water. The great fishery for mackerel is on some parts of the west coast of England. This is of such an extent as to employ, in the whole, a capital of nearly £200,000. The fishermen go out to the distance of several leagues from the shore, and stretch their nets, which are sometimes several miles in extent, across the tide, during the night. The meshes of these nets are just large enough to admit the heads of tolerably large fish, and catch them by the gills. A single boat has been known to bring in, after one night's fishing, a cargo that has sold for nearly seventy pounds. Besides these there is another mode of fishing for mackerel, in the west of England, with a *ground-seine*. A roll of rope of about two hundred fathoms in length, with the net fastened to the end, is tied at the other to a post or rock on the shore. The boat is then rowed to the extremity of this coil, when a pole fixed there, leaded heavily at the bottom, is thrown overboard. The rowers from hence make, as nearly as possible, a semicircle, two men continually and regularly putting the net into the water. When they come to the other end of the net, where there is another leaded pole, they throw that overboard. Another coil of rope, similar to the first, is by degrees thrown into the water, as the boatmen make for the shore. The boat's crew now land, and with the assistance of persons stationed there, haul in each end of the net till they come to the two poles. The boat is then again pushed off towards the centre of the net, in order to prevent the more vigorous fish from leaping over the corks. By these means three or four hundred fish are often caught at one haul.

Mackerel are said to be fond of human flesh. Pontoppidan informs us, that a sailor, belonging to a ship lying in one of the harbours on the coast of Norway, went into the water to wash himself, when he was suddenly missed by his companions. In the course of a few minutes, however, he was seen on the surface, with vast numbers of these fish fastened on him. The people went in a boat to his assistance; and though, when they got him up, they forced with some difficulty the fishes from him, they found it was too late; for the poor fellow shortly afterwards expired.

The roes of the mackerel are used in the Mediterranean for caviar. The blood and slime are first washed off with vinegar, and the sinews and skinny parts taken away. They are then spread out for a short time to dry, and afterwards salted and hung up

in a net, to drain some of the remaining moisture from them. When this is finished they are laid in a kind of sieve, until they are thoroughly dry, and fit for use.

Thunny fish are from two to ten feet in length. The body is round and thick, and tapers nearly to a point both at the head and tail. The skin of the back is very thick and black, and that of the sides and belly silvery, tinged with light blue and pale purple. The tail is crescent-shaped, with the tips far asunder; and the spurious fins between the dorsal fin and the tail (which mark the species) are from eight to eleven in number. On the coasts of Sicily, as well as in several other parts of the Mediterranean, there are very considerable thunny fisheries. The thunnies enter the Mediterranean about the vernal equinox, travelling in a triangular phalanx, so as to cut the water with its point, and to present an extensive base for the tides and currents to act against, and impel forwards. They repair to the warm seas of Greece to spawn, steering their course thither along the European shores; but as they return they approach the African coast: the young fry is placed in the van of the squadron as they travel. They come back from the east in May, and abound at that time on the coast of Sicily and Calabria. "The thunny-fishing," says M. Paul de Musset, "takes place at Palermo about the middle of May. It is a time of festival and fortune for the fishermen. Some days previously a number of coasting vessels establish themselves as a *cordon* of observation along the shore, and at the Cape de Gallo; immense nets having been already spread along the bottom of the Mediterranean, at the spot over which the poor creatures pass every year, and constantly suffer themselves to be taken. In front of the caravan of fish are lighters, which can be seen at a great depth, and a courier is instantly despatched to Palermo to announce the arrival of the thunny. The messenger generally reaches the city about midnight; and at two o'clock the fishing population leave the town. We were in bed when a noise like that of a popular outbreak made us rise at once. *Le borgo* had already departed *en masse*, and the waggons were rapidly following. All the public carriages were provided with a third horse, decorated with bells. We made a bargain with one of these, and started. Waggons filled with people and fishing implements were travelling at the pace of mail-carts, by means of relays. One might have imagined that the inhabitants of Palermo were flying at the approach of a party of Normans or barbarians. The common people had exchanged their velvet vests for linen gaberdines. At daylight we arrived upon the shore, where a great number of boats were in waiting for the actors and spectators of the scene. The boats soon formed a semicircle in battle array round the nets, within which the thunny were doubtlessly still asleep. The thunny, although of great size, is not gifted with much intelligence. He acts from innocent and simple instincts. That of emigration drives it to its ruin, on account of the regularity of its route and the wickedness of man. When once it runs, head-foremost, into the nets which bar its progress, the poor animal has no idea of turning back or of making a circuit. It endeavours to pass over the obstacle, and rises to the surface. There it is that its enemy awaits it, warned of its approach by the foam and fretting of the waters. As soon as the battalion of thunny appear, the fishermen strike and stab with hooks and spears of iron. The more they kill the more victims present themselves. In an instant the whole scene is one sea of blood; the spectators even are inundated with it. Ferocious cries attest the joy of the executioners. The massacre is horrible. Some of the boats are upset by the convulsions of the fish; that is the only danger to which the assassins are sub-

jected. Nothing is thought of but general destruction. In the confusion of despair the thunny remain a considerable time within reach of the boats, then they attempt to escape, and dive to discover some other outlet; those which have not been struck succeed; others, mortally wounded, go and expire in the open sea; the principal number remain on the field of battle: and when no more can be found to kill, the dead fish are collected and packed into the boats, whence they are ultimately transferred to the waggons, which return triumphantly to Palermo." In autumn the thunnies steer northward, and frequent the neighbourhood of Amalphi and Naples. They are not uncommon on the western coasts of Scotland, where they come in pursuit of the herrings, and often during the night strike into the nets, and do considerable damage. When the fishermen draw up these in the morning, the thunny rises at the same time towards the surface, ready to catch the fish that drop out. On its being observed, a line is thrown into the water, having a strong hook baited with a herring, which it seldom fails to seize. As soon as the fish finds itself ensnared, it loses all its active powers, and after very little resistance submits to its fate.

NOTE C.—*The Herring-fishery.*

Herrings prefer the deep water, and, generally speaking, avoid the shoal coasts; and when they do get entangled upon one, great numbers are wrecked. The rocky promontory at the east end of the county of Fife, off which there lies an extensive reef or rock, sometimes has that effect; and there have been seas in which, when the difficulties of the place were augmented by a strong wind at south-east, that carried breakers upon the reef and a heavy surf along the shore, the beach for many miles has been covered with a bank of herrings several feet in depth, which, if taken and salted when first left by the tide, would have been worth many thousands of pounds; but which, as there was not a sufficient supply of salt in the neighbourhood, were allowed to remain putrefying upon the beach, until the farmers found leisure to cart them away as manure. The herring is a remarkably delicate fish, and dies almost the instant that it is out of the water, or gets the slightest injury in it; and these circumstances, while they render the stranded shoals a much more frequent, abundant, and easy prey, than if they were more tenacious of life, cause them to putrefy much sooner. One of those strandings took place in and around the harbour of the small town of Crail only a few years ago, but before the new regulations were passed with regard to salt. The water appeared at first so full of herrings, that half-a-dozen could be taken by one dip of a basket. Numbers of people thronged to the water's edge and fished with great success; and the public crier was sent through the town, to proclaim that "callar herrin"—that is, herrings fresh out of the sea—might be had at the rate of forty a-penny. As the water rose the fish accumulated, till numbers were stunned, and the rising tide was bordered with fish, with which baskets could be filled in an instant. The crier was upon this instructed to alter his note, and the people were invited to repair to the shore and get herrings at one shilling a cart-load. But every successive wave of the flood added to the mass of fish, and brought it nearer to the land, which caused a fresh invitation to whoever might be inclined to come and take what herrings they chose gratis. The fish still continued to accumulate till the height of the flood; and when the water began to ebb, they remained on the beach. It was rather early in the season, so that warm weather might be expected; and the effluvia of so many putrid fish might occasion disease; therefore the corporation offered a reward of one shilling to every one who

would remove a full cart-load of herrings from that part of the shore which was under their jurisdiction;—the fish being immediately from the deep water, were in the highest condition, and barely dead. All the salt from the town and neighbourhood was instantly put in requisition; but it did not suffice for the thousandth part of the mass—a great proportion of which, notwithstanding some not very successful attempts to carry off a few sloop-loads in bulk, was lost. In the bays or "lochs," on the west coast of Scotland, where the shoals of herrings are very abundant, and apt to be driven ashore and stranded by heavy gales from the north-west, these casualties often occur. But though these occurrences are a great and obvious loss, they do not appear to have any effect upon the supply of herrings, whose numbers do not seem capable of apparent diminution, either by the casualties of nature or the schemes of art. The habits of this most abundant, and, perhaps, all things considered, most valuable fish, are but imperfectly known; and they have been a good deal misrepresented. Their apparently capricious visits to particular parts of the coast, which did not seem to depend upon any known law, naturally enough led the inhabitants of the places which they thus periodically but irregularly visited, to impute to them certain superstitious likes and dislikes. The naturalists, too, or those who took upon themselves that character, publishing their opinions from little observation and less reflection, rendered the delusion more extensive and inveterate; till those who had never seen a live herring, were able to trace its migrations in the deep with as much certainty as they could the motion of the hands upon the dial of the village-clock.

The herrings do not come in myriads from the Polar sea, beginning their progress in January, because there are no means of producing them there. Spawn has not been found to animate in any place except floating near the surface, or in shallow water, where both the sun and the air act upon it; and while the Polar seas and shores are open to such action, the herrings are not there; they are on our shores the full-grown and the young. But setting aside the impossibility, the supposed emigration would be without an object; they would not come for food, as they are said to leave the north just when food would be found there! and if they are annually produced in the north, they could not come to our shores for the purpose of spawning, even though they are all obviously in preparation for such a purpose. Beside, there is no animal that migrates southward in the spring, and therefore the theory would require one law for the rest of creation, and another for the herring—that the latter should be chilled by the general warmth of the spring, and warmed by the Polar frost, now, so far is the production of fish from being independent of the influence of heat, that, just as we would be led to infer from the slow progress of the solar beams through the element in which they live, they require the whole, or the greater part of our summer, to mature the germs of their countless broods. Nay, it appears that many, if not most of the species, cannot mature their spawn in the depths of the ocean, to which they retire to recruit their strength; but that they come to the shores and shallows, where the heat of the sun can penetrate to the bottom, and be reflected by it, for the purpose of maturing as well as of depositing their spawn. We know not, and we cannot know, the secrets of those mighty depths which no plummet can fathom; but we have every reason to believe that there is a profundity where animals, constructed as the fishes that we see are, could not by possibility exist. Imagine the pressure of a thousand atmospheres, or between six and seven tons, upon every square inch of surface, and think of the miracle of muscular power which could give motion even to the smallest fish there;

imagine, too, a permanence of state where the air never moves, and the sun never warms; and think what a dwelling for that which must breathe by an apparatus so delicate as the gills of a fish! It may be said, that God is capable of making creatures adapted for living there. We do not deny that he is, neither do we deny their existence; but we deny that the laws of nature are ever violated, which they would be, were the fishes which we know able to move under such a pressure, or propagate, so completely excluded from the action of the sun and the air. The herrings come to the shores and estuaries to mature and propagate their spawn, which they do over a greater range of the year than most other fish, continuing the operation to the middle of winter, and retiring into deeper water after that is done. But there is no reason to conclude that they have much migration in latitude, or that they ever move far from those shores which they frequent in the season. The fry too are found on the shores and in the bays and estuaries frequented by their parents; and they do not go to the deep water till late in the season. They even appear to go farther up the rivers than the old fish, for they may be taken in brackish water with a common trout-fly. The habits of the herring are thus a good deal like those of the salmon; and it is probable that there is a great similarity in the whole *oviparous* fishes; that they all frequent the banks and shoals for the purpose of spawning, and go to some short distance in deeper water to recover their strength. Those which are *viviparous*, or bring forth their young hatched, are under no such necessity; though they follow the others to feed upon them and their spawn or fry, and probably require the influence of the air and heat of the shallow water to perfect the internal hatching of their eggs. It has not been ascertained whether any of these fish spawn every year; but there are some facts which lead to the conclusion that they do not.

The white-fishing, on the east coast of Scotland, which is principally carried on for the common cod (*Morhua vulgaris*), and the haddock (*Morhua ægloffinus*), used to be in a great measure suspended during the spring, when the fish had spawned; but in time, the fishermen found out, that when the fish were neither plentiful nor good upon the shallow banks, they had only to be a little more adventurous, and go into the deep water, in order to be successful all the year round. Now the fish found in the deep water cannot be those which have just spawned, for they are fat and firm, and have young milts and roes in them; and hence there is some probability that the cod, and other fish of the same structure, take two years or more to produce their immense progeny; and that thus there is not a fish in the sea but which is in season all the year, if its place of residence and the mode of taking it were known. It is by these general views that the particular facts are made to connect themselves with the system of nature, and lead to useful discoveries in the arts. When the fish are upon the shores and in the estuaries, nay, when they are upon the wide ocean, they have a host of enemies. All fishes seem to be themselves *omnivorous*—consuming every thing that they can swallow; and the number of sea-birds is perfectly incredible. The numbers that are upon the uninhabited islets in Orkney, Shetland, and the Western isles, as well as at those inaccessible promontories on other parts of the coast, would exceed the belief of any one who has not actually seen them, and yet they are nothing to the numbers found in lonely places, surrounded by more extensive seas.

NOTE D.—White-bait.

Mr. Yarrell, the eminent ichthyologist, has proved historically and anatomically that this little fish was

not, as had been supposed, the young of the shad, but a distinct species. In its habits, it differs from all other species of *clupea* that visit our shores or our rivers. From the beginning of April to the end of September, this fish may be caught in the Thames as high up as Woolwich or Blackwall, every flood-tide, in considerable quantity, by a particular mode of fishing to be hereafter described. During the first three months of this period, neither species of the genus *clupea*, of any age or size, except occasionally a young sprat, can be found and taken in the same situation by the same means. The young shad of the year are not two and a half inches long till November, when the white-bait season is over: and these young shad are never without a portion of that spotted appearance behind the edge of the upper part of the operculum, which, in one species particularly, is so marked a peculiarity in the adult fish. The white-bait, on the contrary, never exhibits a spot at any age; but, from two inches long up to six inches, which is the length of the largest Mr. Yarrell has seen, the colour of the sides is uniformly white. About the end of March, or early in April, white-bait make their appearance in the Thames, and are then small, apparently but just changed from the albuminous state of the young fry; whereas the shad do not deposit their spawn till the end of June, or the beginning of July. During June, July, and August, immense quantities are consumed by visitors to the different taverns at Greenwich and Blackwall.

"The particular mode of fishing for white-bait," says Mr. Yarrell, "by which a constant supply during the season is obtained, was formerly considered destructive to the fry of fishes generally, and great pains were taken to prevent it by those to whom the conservancy of the fishery of the Thames was intrusted; but since the history and habits of this species have been better understood, and it has been ascertained that no other fry of any value can swim with them—which I can aver—the men have been allowed to continue this part of the occupation with little or no disturbance, though still using an unlawful net." Mr. Yarrell describes the net by which white-bait are taken as by no means large, measuring only about 3 or 4 feet in extent; but the mesh of the hose, or bag end of the net, is very small. The boat is moored in the tideway, where the water is from 23 to 30 feet deep; and the net, with its wooden framework, is fixed to the side of the boat. The tail of the hose, swimming loose, is from time to time handed into the boat, the end untied, and its contents shaken out. The wooden frame forming the mouth of the net does not dip more than four feet below the surface of the water; and, except an occasional straggling fish, the only small fry taken with the white-bait, are sticklebacks and the spotted or freckled groby. The farther the fishermen go down towards the mouth of the river, the sooner they begin to catch white-bait after the flood-tide has commenced. When fishing as high as Woolwich, the tide must have flowed from three to four hours, and the water become sensibly brackish to the taste, before the white-bait will appear. They return down the river with the first of the ebb-tide; and various attempts to preserve them in well-boats in pure fresh water have uniformly failed. The Thames fishermen who live at and below Gravesend, know the white-bait perfectly, and catch them occasionally of considerable size in the small meshed nets used in the Upper and Lower Hope for taking shrimps, called trinker-nets, which are like white-bait nets, only larger. The sprat-fishers take the adult white-bait frequently on the Kentish and Essex coasts throughout the winter. The Hamble, which runs into the Southampton waters, is the only other southern river from which Mr. Yarrell has received white-bait; but this he believes to be owing

rather to the want of a particular mode of fishing, by which so small a fish can be taken so near the surface, than to the absence of the fish itself; which, abounding as it does in the Thames, Mr. Yarrell has very little doubt might be caught in some of the neighbouring rivers on our south and east coasts. In the vicinity of the Isle of Wight, white-bait, from their brilliancy and consequent attraction, are used by the fishermen as bait on their lines when fishing for whittings; hence the name. Dr. Parnell has found white-bait inhabiting the frith of Forth in considerable numbers, during the summer-months; and in the neighbourhood of Queensferry he has captured in one dip of a net, about a foot and a half square, between 200 and 300 fish, not more than two inches in length, mixed with sprats, young herrings, and fry of other fishes. "In their habits," says Dr. Parnell, "white-bait appear to be similar to the young of the herring, always keeping in shoals, and swimming occasionally on the surface of the water, where they often fall a prey to aquatic birds." White-bait being thus added to the delicacies of the Scottish table, it is expected to be hereafter sent to the Edinburgh market in such quantities as to render it as profitable as the sperling or smelt fishery. Mr. Yarrell thus technically describes the white-bait:—"The length of the head compared with that of the body alone is as two to five; the depth of the body compared to the whole length of the fish, as one to five; the dorsal fin commences half-way between the point of the closed jaws and the ends of the short and middle caudal rays; the longest ray of the dorsal fin as long as the base of the fin; the ventral fin arises from behind the line of the commencement of the dorsal, and half-way between the point of the closed jaws and the end of the longest caudal rays;

the tail long and deeply forked. The head is elongated; the dorsal line less convex than that of the abdomen; the scales deciduous; the abdominal line strongly serrated from the pectoral fin to the anal aperture. The lower jaw the longest and smooth; the upper slightly crenated; the tongue with an elevated central ridge without teeth; the eye large, the irides silvery; the upper part of the back pale greenish ash; all the lower part, the cheeks, gill-covers, sides, and belly, silvery white; dorsal and caudal fins coloured like the back; the latter tipped with dusky: pectoral, ventral, and anal fins, white." The only food Mr. Yarrell could find in the stomach were the remains of minute crustacea.

The fish should be cooked within an hour after being caught, or they are apt to cling together; they are kept in water in a pan, from which they are taken, as required, by a skimmer. They are then thrown upon a layer of flour, contained in a large napkin, in which they are shaken until completely enveloped in flour; they are then put into a cullender, and all the superfluous flour is removed by sifting; the fish are next thrown into hot lard, contained in a copper caldron or stew-pan placed over a charcoal fire; in about two minutes they are removed by a tin skimmer, thrown into a cullender to drain, and served up instantly, by placing them on a fish-drainer in a dish. The rapidity of the cooking process is of the utmost importance; and if it be not attended to, the fish will lose their crispness, and be worthless. To temper their richness, lemon-juice is squeezed over them, and they are seasoned with cayenne pepper; brown bread and butter are substituted for plain bread; whilst they are "washed down" with punch.

BOOK IV.

OF CRUSTACEOUS AND TESTACEOUS FISHES.

CHAP. I.

THE DIVISION OF SHELL-FISH.

IN describing the inhabitants of the water, a class of animals occur, that mankind, from the place of their residence, have been content to call fish; but that naturalists, from their formation, have justly agreed to be unworthy of the name. Indeed the affinity many of this kind bear to the insect tribe, may very well plead for the historian who ranks them rather as insects. However, the common language of a country must not be slightly invaded; the names of things may remain, if the philosopher be careful to give precision to our ideas of them.

There are two classes of animals, therefore, inhabiting the water, which commonly receive the name of fishes, entirely different from those we have been describing, and also very distinct from each other. These are divided by naturalists into Crustaceous and Testaceous animals: both,

totally unlike fishes to appearance, seem to invert the order of nature; and as those have their bones on the inside, and their muscles hung upon them for the purposes of life and motion, these, on the contrary, have all their bony parts on the outside, and all their muscles within. Not to talk mysteriously—all who have seen a lobster or an oyster, perceive that the shell in these bears a strong analogy to the bones of other animals; and that, by these shells, the animal is sustained and defended.

Crustaceous fish, such as the crab and the lobster, have a shell not quite of a stony hardness, but rather resembling a firm crust, and in some measure capable of yielding.—Testaceous fishes, such as the oyster or cockle, are furnished with a shell of a stony hardness; very brittle, and incapable of yielding. Of the crustaceous kinds are the Lobster, the Crab, and the Tortoise: of the testaceous, that numerous tribe of Oysters, Mussels, Cockles, and Sea-snails, which offer with infinite variety.

The crustaceous tribe seem to hold the middle rank between fishes, properly so called, and those snail-like animals that receive the name of testaceous fishes. Their muscles are strong and firm, as in the former; their shell is self-produced, as among the latter. They have motion, and hunt for food with great avidity, like the former. They are incapable of swimming, but creep along the bottom, like the latter: in short, they form the link that unites these two classes, that seem so very opposite in their natures.

Of testaceous fishes we will speak hereafter. As to animals of the crustaceous kind, they are very numerous, their figure offers a hundred varieties: but as to their nature, they are obviously divided into two very distinct kinds, differing in their habits and their conformation.—The chief of one kind is the Lobster; the chief of the other, the Tortoise. Under the Lobster we rank the Prawn, the Cray-fish, the Shrimp, the Sea-crab, the Land-crab, and all their varieties. Under the Sea-tortoise, the Turtle, the Hawksbill-turtle, the Land-tortoise, and their numerous varieties.

CHAP. II.

CRUSTACEOUS ANIMALS OF THE LOBSTER KIND.

HOWEVER different in figure the lobster and the crab may seem, their manners and conformation are nearly the same. With all the voracious appetites of fishes, they are condemned to lead an insect life at the bottom of the water; and though pressed by continual hunger, they are often obliged to wait till accident brings them their prey. Though without any warmth in their bodies, or even without red blood circulating through their veins, they are animals wonderfully voracious. Whatever they seize upon that has life, is sure to perish, though never so well defended: they even devour each other; and, to increase our surprise still more, they may, in some measure, be said to eat themselves: as they change their shell and their stomach every year, and their old stomach is generally the first morsel that serves to glut the new.¹

The lobster is an animal of so extraordinary a form, that those who first see it are apt to mistake the head for the tail; but it is soon discovered that the animal moves with its claws foremost; and that the part which plays within itself by joints, like a coat of armour, is the tail. The two great claws are the lobster's instruments of provision and defence; these, by opening like a pair of nippers, have great strength, and take a firm hold: they are usually notched like a saw, which still more increases their tenacity. Beside these powerful instruments, which may be

considered as arms, the lobster has eight legs, four on each side, and these, with the tail, serve to give the animal its progressive and sideling motion. Between the two claws is the animal's head, very small, and furnished with eyes that seem like two black horny specks on each side; and these it has a power of advancing out of the socket, and drawing in, at pleasure. The mouth, like that of insects, opens the long way of the body, not crossways, as with man and the higher race of animals. It is furnished with two teeth for the comminution of its food; but, as these are not sufficient, it has three more in the stomach; one on each side, and the other below. Between the two teeth there is a fleshy substance, in the shape of a tongue. The intestines consist of one long bowel, which reaches from the mouth to the vent; but what this animal differs in from all others, is, that the spinal marrow is in the breast-bone. It is furnished with two long feelers or horns, that issue on each side of the head, that seem to correct the dimness of its sight, and apprise the animal of its danger, or of its prey. The tail, or that jointed instrument at the other end, is the great instrument of motion; and with this it can raise itself in the water. Under this we usually see lodged the spawn in great abundance; every pea adhering to the next by a very fine filament, which is scarcely perceivable. Every lobster is an hermaphrodite, and is supposed to be self-impregnated!² The ovary, or place where the spawn is first produced, is backwards toward the tail, where a red substance is always found, and which is nothing but a cluster of peas, that are yet too small for exclusion. From this receptacle there go two canals, that open on each side at the jointures of the shell, at the belly; and through these passages the peas descend to be excluded, and placed under the tail, where the animal preserves them from danger for some time, until they come to maturity; when, being furnished with limbs and motion, they drop off into the water.

When the young lobsters leave the parent, they immediately seek for refuge in the smallest clefts of rocks, and in such like crevices at the bottom of the sea, where the entrance is but small, and the opening can be easily defended. There, without seeming to take any food, they grow larger in a few weeks' time, from the mere accidental substances which the water washes to their retreats. By this time, also, they acquire a hard firm shell, which furnishes them with both offensive and defensive armour. They then begin to issue from their fortresses, and boldly creep along the bottom, in hopes of meeting with more diminutive plunder. The spawn of fish, the smaller animals of their own kind, but chiefly

² The animals of this tribe are by no means hermaphrodites, but are found distinctly male and female. The eggs are deposited under the tail of the females, which for that purpose is often much broader than that of the males.—Ed.

¹ See Note 4, p. 308.

the worms that keep at the bottom of the sea, supply them with plenty. They keep in this manner close among the rocks, busily employed in scratching up the sand with their claws for worms, or surprising such heedless animals as fall within their grasp: thus they have little to apprehend, except from each other; for in them, as among fishes, the large are the most formidable of all other enemies to the small.

But this life of abundance and security is soon to have a most dangerous interruption; for the body of the lobster still continuing to increase, while its shell remains unalterably the same, the animal becomes too large for its habitation, and, imprisoned within the crust that it has naturally gathered round it, there comes on a necessity of getting free. The young of this kind, therefore, that grow faster, as I am assured by the fishermen, change their shell oftener than the old, who come to their full growth, and who remain in the same shell often for two years together. In general, however, all these animals change their shell once a-year; and this is not only a most painful operation, but also subjects them to every danger. Their moulting season is generally about the beginning of summer, at which time their food is in plenty, and their strength and vigour in the highest perfection. But soon all their activity ceases; they are seen forsaking the open parts of the deep, and seeking some retired situation among the rocks, or some outlet where they may remain in safety from the attacks of their various enemies. For some days before their change, the animal discontinues its voraciousness; it is no longer seen laboriously harrowing up the sand at the bottom, or fighting with others of its kind, or hunting its prey; it lies torpid and motionless, as if in anxious expectation of the approaching change. Just before casting its shell, it throws itself upon its back, strikes its claws against each other, and every limb seems to tremble; its feelers are agitated, and the whole body is in violent motion; it then swells itself in an unusual manner, and at last the shell is seen beginning to divide at its junctures; particularly, it opens at the junctures of the belly, where, like a pair of jumps, it was before but seemingly united. It also seems turned inside out, and its stomach comes away with its shell. After this, by the same operation, it disengages itself of the claws, which burst at the joints; the animal, with a tremulous motion, casting them off as a man would kick off a boot that was too big for him.

Thus, in a short time, this wonderful creature finds itself at liberty, but in so weak and enfeebled a state, that it continues for several hours motionless. Indeed, so violent and painful is the operation, that many of them die under it; and those which survive are in such a weakly state for some time, that they neither take food nor venture from their retreats. Immediately after this change, they have not only the softness but

the timidity of a worm. Every animal of the deep is then a powerful enemy, which they can neither escape nor oppose; and this, in fact, is the time when the dog-fish, the cod, and the ray, devour them by hundreds.³ But this state of defenceless imbecility continues for a very short time: the animal, in less than two days, is seen to have the skin that covered its body grown almost as hard as before; its appetite is seen to increase; and, strange to behold! the first object that tempts its gluttony, is its own stomach, which it so lately was disengaged from. This it devours with great eagerness; and some time after eats even its former shell. In about forty-eight hours, in proportion to the animal's health and strength, the new shell is perfectly formed, and as hard as that which was but just thrown aside.

To contribute to the speedy growth of the shell, it is supposed by some, that the lobster is supplied with a very extraordinary concretion within its body, that is converted into the shelly substance. It is a chalky substance, found in the lower part of the stomach of all lobsters, improperly called crabs' eyes, and sold under that title in the shops. About the time the lobster quits its shell, the teeth in its stomach break these stones to pieces, and the fluids contained therein

³ Dr. Darwin says—on the authority of a friend who had been engaged in surveying the sea-coasts—that a hard-shelled crab always stands sentinel, to prevent the sea-insects from injuring the rest in their defenceless state; and that, from his appearance, the fishermen know where to find the soft ones, which they use for bait in catching fish; adding that, though the hard-shelled crab, when he is on his duty, advances boldly to meet the foe, and will with difficulty quit the field, yet at other times he shows great timidity, and is very expeditious in effecting his escape. If, however, he be often interrupted, he will pretend death, like the spider, and watch an opportunity to sink himself in the sand, keeping only his eyes above. The fishermen, when they take a crab that is not in good condition, return it to the sea, and sometimes mark it on the back with a sharp-pointed instrument, or the end of a knife; and it is very surprising, that this mark may not only be seen to remain on the old shell, but that it is also found impressed on the subsequent new one. These men also say, that when crabs have had their shells marked, and been carried out to the distance of two or three miles, and thrown among others, they will also find their way back again: this the men have often observed by catching them in their former haunts. These animals are naturally very quarrelsome, and frequently have serious contests by means of those formidable weapons, their great claws. With these they lay hold of their adversary's legs; and whatever they seize, it is not easy to make them forego their hold. They frequently retain some portion of a leg or limb as a token of victory. In order to prove the extreme tenacious disposition of the crab, a fisherman, in the presence of Mr. Collinson, made, by irritation, a crab seize one of its own small claws with a large one. The foolish creature did not distinguish that it was itself the aggressor, but exerted its strength, and soon cracked the shell of the small claw. Feeling itself wounded, it cast off the piece in the usual place, but continued to retain the hold with the great claw for a long time afterward.—Ed.

dissolve them. This fluid, which still remains in the new stomach, is thought to be replete with a petrifying quality, proper for forming a new shell: however, the concreting power that first formed these, shows a sufficient power in the animal to produce also the shell; and it is going but a short way in the causes of things when we attempt to explain one wonder by another.⁴

When the lobster is completely equipped in its new shell, it then appears how much it has grown in the space of a few days; the dimensions of the old shell being compared with those of the new, it will be found that the creature is increased above a third in its size; and, like a boy that has outgrown his clothes, it seems wonderful how the deserted shell was able to contain so great an animal as entirely fills up the new.

The creature thus furnished, not only with a complete covering, but also a greater share of strength and courage, ventures more boldly

⁴ Baer has proved that the crab's stomach consists of two coats; one inner, which in every respect may be compared to a callous, horny epidermis, and which is destitute of vitality; and an outer or containing coat, transparent, but sufficiently strong and vascular. The inner coat, as it is well known, consists of various and very curious parts, some resembling bony plates, others compared to teeth. Now, at the period when the crab changes its skin, it likewise casts the inner coat of the stomach, and on this account this process, analogous to the moulting of birds, and to the renewing of the hair in quadrupeds, is in the crab attended with very great constitutional disturbance, and a total interruption of the digestive function. Baer relates very accurately the changes which the stomach undergoes preparatory to the casting of its inner coat. It would be beside our present purpose to follow him in this description, however interesting. Some things he mentions are, however, specially worthy of remark. In the first place, the softer parts of the old epidermis, or inner coat of the stomach, are very rapidly digested in the stomach, as soon as it has recovered its functions, and has—which it does quickly—formed a new lining on its inner surface. But there are other harder parts that cannot be readily digested and dissolved, and which are otherwise disposed of. The hard and hollow bones, popularly termed the teeth, are got rid of by being discharged through the external orifice corresponding to the mouth. There are other solid plates of the epidermic portion of the stomach, which are not of a shape calculated to irritate the new and tender epidermis, and consequently they can be retained with impunity, and are destined to perform a new and curious function; for, according to Baer, these plates, for some time preparatory to the act of casting the shells, rapidly increase in weight and in solidity, so as, at the period we are speaking, they may be considered as forming considerable reservoirs of earthy matter, to be gradually dissolved and digested in the newly lined stomach, at the very time earthy matter is required by the animal for the formation of its new shell. These plates are popularly called *Crab-stones*, and when submitted to the digestive process soon lose their roughness, and become smooth and polished before they are entirely dissolved. These crab-stones are chiefly composed of carbonate of lime; and Baer has proved, by repeated analysis, that the fluid contents of a crab's stomach contain (at the time these stones are in them) a considerable portion of lime, carbonic acid, and muriatic acid.—ED.

among the animals at the bottom; and not a week passes, that, in its combats, it does not suffer some mutilation. A joint, or even a whole claw, is sometimes snapped off in these encounters. At certain seasons of the year these animals never meet each other without an engagement. In these, to come off with the loss of a leg, or even a claw, is considered as no great calamity; the victor carries off the spoil to feast upon at leisure, while the other retires from the defeat to wait for a thorough repair. This repair it is not long in procuring. From the place where the joint of the claw was cut away, is seen in a most surprising manner to burgeon out the beginning of a new claw. This, if observed at first, is small and tender, but grows, in the space of three weeks, to be almost as large and as powerful as the old one. I say almost as large, for it never arrives to the full size; and this is the reason we generally find the claws of lobsters of unequal magnitude.⁵

⁵ In the water, these animals are able to run nimbly upon their legs or small claws; and, if alarmed, they can spring, tail foremost, to a surprising distance, almost as swiftly as a bird can fly. The fishermen can see them pass about thirty feet; and, what is not less surprising than true, will throw themselves into their hold in that manner, as is frequently seen by the people who endeavour to catch them at Filey-bridge, near Scarborough. The circumstance of lobsters losing their claws at thunder-claps, or on the sound of cannon, is well authenticated; and the fishermen are often jestingly saluted by the sailors. The restoration of claws thus lost may always be observed; for these never again grow to their former size. When the claws of lobsters become inconvenient from being by any means injured, they always break them off. At a late meeting of the Penzance Natural History Society a paper on the reproduction of amputated parts in the lower animals was read by Mr. R. W. Cough. In the course of the essay the following facts were mentioned:—A specimen of the Triton having been found which had received so severe an injury that its hinder leg had been crushed, it was amputated above the injured part, and the animal so placed that it could be watched every day. In the course of five days the wound had healed, but it appeared that the period of healing depended on the temperature, for the healing was far more rapid in June, July, and August, than at any other period. It appears that after the amputated leg has become healed for a short time, varying to ten days, a red point is seen in the centre of the scar, which is formed of blood-vessels; this increases in size, and stands in a short cone from the skin. As it increases in size the red part becomes pale and the base pellucid, and then it gets marked in a curious manner, and forms in fact a new thigh. This new part continues conical for some time, but gradually enlarges at the point, and becomes bulbous. A red point appears on the new as on the old part, and goes on in the same way, and the lower leg is formed joint after joint, every joint of the toes is formed as separately and distinctly as the larger ones, till a perfect limb is produced. The new parts are not in due proportion with older portions, but about one-third the perfect size. This, however, is gradually remedied by the gradual growth of the parts, so that about the 115th day after the operation, the new limb is hardly to be distinguished from the old ones. On dissection it appears that the continuation of the vessels, nerves, and muscles

After what has been thus described, let us pause a little, to reflect on the wonders that this extraordinary creature offers to our imagination! An animal without bones on the inside, yet furnished with a stomach capable of digesting the hardest substances, the shells of mussels, of oysters, and even its own; an animal gaining a new stomach and a new shell at stated intervals! furnished with the instruments of generation double in both sexes; and yet with an apparent incapacity of uniting! without red blood circulating through the body, and yet apparently vigorous and active! but, most strange of all, an animal endowed with a vital principle that furnishes out such limbs as have been cut away; and keeps continually combating it, though in constant repair to renew its engagements! These are but a small part of the wonders of the deep, where nature sports without a spectator!

Of this extraordinary yet well-known animal there are many varieties, with some differences in the claws, but little in the habits or conformation.⁶ It is found above three feet long; and if

is similar to that of the old parts, though in the early stage of the re-development such is not the case. Some observations were made on the variety of the circulation observed in the old and new parts, by which it appeared that the blood-vessels had an action independent of the heart. The crustaceans were then referred to, and it appears that they have even a greater facility of shedding and renewing their claws. They can, however, only lose their claws at the joint, and that at the one near the body. This they do, if a claw happens to be imprisoned between stones or designedly; they then shed their claw, leaving it behind, and make their escape. The whole claw is formed at once, and enclosed in a very delicate membrane. In this state they lie, till the animal sheds its shell for the purpose of growth, it then rapidly enlarges, but does not attain its full size till after repeated sheddings. This fact, it appears, is turned to rather a curious profit by some of the fishermen.—Ed.

⁶ The *Norway lobster* has generally eight legs, besides two claspers, with six unequal feelers; two eyes, commonly distant, placed on fast stakes, and moveable; the tail is articulated and unarmed. The body is long, with the thorax aculeated forwards; and prismatic arms, with the angles spiny. This species is nearly equal in size to the common lobster, and is principally found in the northern ocean. It also inhabits Great Britain.

Prawns have a long serrated snout, bending upwards; three pair of very long filiform feelers; claws small, furnished with two fangs; smooth thorax; five joints to the tail; middle caudal fin subulated, two outmost flat and rounded. It is frequent in several shores among loose stones; sometimes found at sea, and taken on the surface over thirty fathoms depth of water: cinereous when fresh, and of a fine red when boiled.

Shrimps possess long slender feelers, and, between them, two projective laminae; the claws have a single-hooked moveable fang; they have three pair of legs; seven joints in the tail; the middle caudal fin subulated, the four others round and fringed; a spine on the exterior side of each of the outmost. These animals inhabit the shores of Britain in vast quantities, and are the most delicious of the genus.

The *Squilla* has a snout like a prawn, but deeper and thinner; the feelers longer in proportion to the

we may admit the shrimp and the prawn into the class, though unfurnished with claws, it is seen not above an inch. These all live in the water, and can bear its absence for but a few hours. The shell is black when taken out of the water, but turns red by boiling. The most common way of taking the lobster is in a basket, or pot, as the fishermen call it, made of wicket-work, in which they put the bait, and then throw it to the bottom of the sea, in six or ten fathom water. The lobsters creep into this for the sake of the bait, but are not able to get out again. The river *craw-fish*⁷ differs little from the lobster, but that the one will live only in fresh-water, and the other will thrive only in the sea.

The crab is an animal found equally in fresh and salt water; as well upon land as in the ocean.

bulk; the sub-caudal fins rather larger. This animal is, at full growth, not above the bulk of the shrimp. The *squilla* inhabits the coast of Kent, and is sold in London under the name of the white shrimp, as it assumes that colour when boiled.—Ed.

⁷ This species of lobster has a projecting snout, slightly serrated on the sides; a smooth thorax; the back smooth, with two small spines on each side; the claws large, beset with small tubercles; the two first pair of legs clawed, the two next subulated; the tail consists of five joints; and the caudal fins are rounded. The flesh of the *craw-fish* is cooling, moistening, and adapted to nourish such as labour under consumptions. Though they are variously dressed, yet no parts of them are eatable except their claws and tails. Soups are frequently made of them, which are rendered still more medicinal by the addition of herbs, snails, or other substances, according to the intention of the physician. The flesh is accounted best in the summer months; but the delicate flavour of these fish depends in a great measure on their food. When they have well-tasted food their flesh preserves the relish of it; but when they feed on other things, they are often rendered of no value by the flavour communicated to their flesh by them. There are great quantities of these fish in the river Obra, on the borders of Silesia; but the people find them scarcely eatable, because of a bitter aromatic flavour, very disagreeable in food. It has lately been observed, that the *calamus aromaticus* grows in vast abundance on the banks of that river, and that these creatures feed greedily upon its roots. *Craw-fish* also abound in the river Don, in Muscovy, where they are laid in heaps to putrefy, after which the stones called crabs' eyes are picked out. These animals are very greedy of flesh, and flock in great numbers about carcasses thrown in the water where they are, and never leave them while any remains: they also feed on dead frogs when they come in their way. In Switzerland there are some *craw-fish* which are red when they are alive, and others bluish. Some kinds of them also will never become red, even by boiling, but continue blackish. *Craw-fish* are found in many of our rivers lodged in holes which they form in the clayey banks; and their presence is generally esteemed an evidence of the goodness of the water. They are frequently taken by means of sticks, split at the end, with a bait inserted in the cleft, and stuck in the mud at the distance of a few feet from each other. These sticks, after remaining some time, are taken up, generally with an animal adhering to each. They are gently drawn out of the mud, and a basket is put under them, to receive the animals which always drop off when brought to the surface of the water.—Ed.

In shape it differs very much from the lobster, but entirely resembles it in habits and conformation. The tail in this animal is not so apparent as in the former, being that broad flap that seems to cover a part of the belly, and when lifted discovers the peas or spawn, situated there in great abundance. It resembles the lobster in the number of its claws, which are two; and its legs, which are eight, four on either side. Like the lobster, it is a bold voracious animal; and such an enmity do crabs bear each other, that those who carry them for sale to market, often tie their claws with strings to prevent their fighting and maiming themselves by the way. In short, it resembles the lobster in every thing but the amazing bulk of its body compared to the size of its head, and the length of its intestines, which have many convolutions.

As the crab, however, is found upon land as well as in water, the peculiarity of its situation produces a difference in its habitudes, which it is proper to describe. The Land crab is found in some of the warmer regions of Europe, and in great abundance in all the tropical climates in Africa and America. They are of various kinds, and endued with various properties; some being healthful, delicious, and nourishing food; others, poisonous or malignant to the last degree; some are not above half-an-inch broad, others are found a foot over; some are of a dirty brown, and others beautifully mottled. That animal called the Violet crab of the Caribbee Islands, is the most noted, both for its shape, the delicacy of its flesh, and the singularity of its manners.

The Violet crab somewhat resembles two hands cut through the middle and joined together; for each side looks like four fingers, and the two nippers or claws resemble the thumbs. All the rest of the body is covered with a shell as large as a man's hand, and bunched in the middle, on the fore-part of which there are two long eyes of the size of a grain of barley, as transparent as crystal, and as hard as horn. A little below these is the mouth, covered with a sort of barbs, under which there are two broad sharp teeth as white as snow. They are not placed, as in other animals, crossways, but in the opposite direction, not much unlike the blades of a pair of scissors. With these teeth they can easily cut leaves, fruits, and rotten wood, which is their usual food. But their principal instrument for cutting and seizing their food is their nippers, which catch such a hold, that the animal loses the limb sooner than its grasp, and is often seen scampering off, having left its claw still holding fast upon the enemy. The faithful claw seems to perform its duty, and keeps for above a minute fastened upon the finger while the crab is making off.³ In fact, it loses no great matter by leaving a leg or an arm, for they soon grow again, and the animal is found as perfect as before.

This, however, is the least surprising part of this creature's history; and what I am going to relate, were it not as well known and as confidently confirmed as any other circumstance in natural history, it might well stagger our belief. These animals live not only in a kind of orderly society in their retreats in the mountains, but regularly once a-year march down to the sea-side in a body of some millions at a time. As they multiply in great numbers, they choose the months of April or May to begin their expedition; and then sally out by thousands from the stumps of hollow trees, from the clefts of the rocks, and from the holes which they dig for themselves under the surface of the earth. At that time the whole ground is covered with this band of adventurers; there is no setting down one's foot without treading upon them.⁹ The sea is their place of destination, and to that they direct their march with right-lined precision. No geometrician could send them to their destined station by a shorter course; they neither turn to the right nor left, whatever obstacles intervene; and even if they meet with a house, they will attempt to scale the walls to keep the unbroken tenor of their way. But though this be the general order of their route, they upon other occasions are compelled to conform to the face of the country; and if it be intersected by rivers, they are seen to wind along the course of the stream. The procession sets forward from the mountains with the regularity of an army, under the guidance of an experienced commander. They are commonly divided into three battalions; of which the first consists of the strongest and boldest males, that, like pioneers, march forward to clear the route, and face the greatest dangers. These are often obliged to halt for want of rain, and go into the most convenient encampment till the weather changes. The main body of the army is composed of females, which never leave the mountains till the rain is set in for some time, and then descend in regular battalia, being formed into columns of fifty paces broad and three miles deep, and so close that they almost cover the ground. Three or four days after this, the rear-guard follows; a straggling undisciplined tribe consisting of males and females, but neither so robust nor so numerous as the former. The night is their chief time of proceeding; but if it rains by day, they do not fail to profit by the occasion; and they continue to move forward in their slow uniform manner. When the sun shines and is hot upon the surface of the ground, they then make a universal halt, and wait till the cool of the evening. When they are terrified, they march back in a confused disorderly manner, holding up their nippers, with which they sometimes tear off a piece of the skin, and then leave the weapon where they inflicted the wound. They

³ Brown's Jamaica, p. 423.

⁹ Labat. Voyage aux Isles Françaises, vol. ii p. 221.

even try to intimidate their enemies; for they often clatter their nippers together, as if it were to threaten those that come to disturb them. But though they thus strive to be formidable to man, they are much more so to each other; for they are possessed of one most unsocial property, which is, that if any of them by accident is maimed in such a manner as to be incapable of proceeding, the rest fall upon and devour it on the spot, and then pursue their journey.

When after a fatiguing march, and escaping a thousand dangers, (for they are sometimes three months in getting to the shore,) they have arrived at their destined port, they prepare to cast their spawn. The peas are as yet within their bodies, and not excluded, as is usual in animals of this kind, under the tail; for the creature waits for the benefit of the sea-water to help the delivery. For this purpose, the crab has no sooner reached the shore, than it eagerly goes to the edge of the water, and lets the waves wash over its body two or three times. This seems only a preparation for bringing their spawn to maturity; for without farther delay they withdraw to seek a lodging upon land: in the meantime the spawn grows larger, is excluded out of the body, and sticks to the barbs under the flap, or more properly the tail. This bunch is seen as big as a hen's egg, and exactly resembling the roes of herrings. In this state of pregnancy, they once more seek the shore for the last time, and shaking off their spawn into the water, leave accident to bring it to maturity. At this time whole shoals of hungry fish are at the shore, in expectation of this annual supply; the sea to a great distance seems black with them; and about two-thirds of the crabs-eggs are immediately devoured by these rapacious invaders. The eggs that escape are hatched under the sand; and soon after millions at a time of these little crabs are seen quitting the shore, and slowly travelling up to the mountains.

The old ones, however, are not so active to return; they have become so feeble and lean, that they can hardly creep along, and the flesh at that time changes its colour. The most of them, therefore, are obliged to continue in the flat parts of the country till they recover, making holes in the earth, which they cover at the mouth with leaves and dirt, so that no air may enter. There they throw off their old shells, which they leave as it were quite whole, the place where they opened on the belly being unseen. At that time they are quite naked, and almost without motion for six days together, when they become so fat as to be delicious food. They have then under their stomachs four large white stones, which gradually decrease in proportion as the shell hardens, and when they come to perfection are not to be found. It is at that time that the animal is seen slowly making its way back; and all this is most commonly performed in the space of six weeks.

This animal, when possessed of its retreats in the mountains, is impregnable; for only subsisting upon vegetables, it seldom ventures out; and its habitation being in the most inaccessible places, it remains for a great part of the season in perfect security. It is only when impelled by the desire of bringing forth its young, and when compelled to descend into the flat country, that it is taken. At that time the natives wait for its descent in eager expectation, and destroy thousands: but disregarding the bodies, they only seek for that small spawn which lies on each side of the stomach within the shell; of about the thickness of a man's thumb. They are much more valuable upon their return, after they have cast their shell; for being covered with a skin resembling soft parchment, almost every part except the stomach may be eaten. They are taken in their holes by feeling for them in the ground with an instrument: they are sought after by night, when on their journey, with flambeaux. The instant the animal perceives itself attacked, it throws itself on its back, and with its claws pinches most terribly whatever it happens to fasten on. But the dexterous crab-catcher takes them by the hinder legs in such a manner, that its nippers cannot touch him, and thus he throws it into his bag. Sometimes also they are caught when they take refuge at the bottom of holes, in rocks by the sea-side, by clapping a stick at the mouth of the hole, which prevents their getting out; and then soon after the tide coming, enters the hole, and the animal is found, upon its retiring, drowned in its retreat.

These crabs are of considerable advantage to the natives; and the slaves very often feed entirely upon them. In Jamaica, where they are found in great plenty, they are considered as one of the greatest delicacies of the place. Yet still, the eating of them is attended with some danger; for even of this kind many are found poisonous, being fed, as it is thought, upon the manchineel apple; and whenever they are found under that noxious plant, they are always rejected with caution. It is thus with almost all the productions of those luxurious climates; however tempting they may be to the appetite, they but too often are found destructive; and scarce a delicacy among them that does not carry its own alloy.

The descent of these creatures for such important purposes, deserves our admiration; but there is an animal of the lobster kind that annually descends from its mountains in like manner, and for purposes still more important and various. Its descent is not only to produce an offspring, but to provide itself a covering; not only to secure a family, but to furnish a house. The animal I mean is the Soldier crab, which has some similitude to the lobster, if divested of its shell. It is usually about four inches long, has no shell behind, but is covered down to the tail with a rough skin, terminating in a point. It is,

however, armed with strong hard nippers before, like the lobster; and one of them is as thick as a man's thumb, and pinches most powerfully. It is, as I said, without a shell to any part except its nippers; but what nature has denied this animal, it takes care to supply by art; and taking possession of the deserted shell of some other animal, it resides in it, till, by growing too large for its habitation, it is under a necessity of change. It is a native of the West India Islands; and, like the former, it is seen every year descending from the mountains to the sea-shore, to deposit its spawn, and to provide itself with a new shell. This is a most bustling time with it, having so many things to do; and in fact, very busy it appears. It is very probable that its first care is to provide for its offspring, before it attends to its own wants; and it is thought, from the number of little shells which it is seen examining, that it deposits its spawn in them, which thus is placed in perfect security till the time of exclusion.

However this be, the soldier is in the end by no means unmindful of itself. It is still seen in its old shell, which it appears to have considerably outgrown; for a part of the naked body is seen at the mouth of it, which the habitation is too small to hide. A shell, therefore, is to be found large enough to cover the whole body; and yet not so large as to be unmanageable and unwieldy. To answer both these ends, is no easy matter, nor the attainment of a slight inquiry. The little soldier is seen busily parading the shore along that line of pebbles and shells that is formed by the extremest wave; still, however, dragging its old incommensurate habitation at its tail, unwilling to part with one shell, even though a troublesome appendage, till it can find another more convenient. It is seen stopping at one shell, turning it, and passing it by, going on to another, contemplating that for a while, and then slipping its tail from its old habitation, to try on the new. This also is found to be inconvenient; and it quickly returns to its old shell again. In this manner it frequently changes, till at last it finds one light, roomy, and commodious; to this it adheres, though the shell be sometimes so large as to hide the body of the animal, claws, and all.¹⁰ Yet it is not till after many trials, by many combats also, that the soldier is thus completely equipped; for there is often a contest between two of them for some well-looking favourite shell for which they are rivals. They both endeavour to take possession; they strike with their claws, they bite each other, till the weakest is obliged to yield, by giving up the object of dispute. It is then that the victor immediately takes possession, and parades it in his new conquest three or four times backward and forward upon the strand before his envious antagonist.

¹⁰ Pere du Festre.

When this animal is taken, it sends forth a feeble cry, endeavouring to seize the enemy with its nippers; which if it fastens upon, it will sooner die than quit the grasp. The wound is very painful, and not easily cured. For this reason, and as it is not much esteemed for its flesh, it is generally permitted to return to its old retreat to the mountains in safety. There it continues till the necessity of changing once more, and the desire of producing an offspring expose it to fresh dangers the year ensuing.

SUPPLEMENTARY NOTE.

The *Sand crab* is but of a small size; its colour light brown or dusky white. It has eight legs and two claws, one of which is double the size of the other: these claws serve both to defend and feed themselves with. The head has two square holes, which are receptacles for its eyes, out of which it thrusts them, and draws them in again at pleasure. Their abode is only on the sandy shores of Flathera, and many other of the Bahama islands. They run very fast, and retreat from danger into little holes they make in the sand.

The *Red-mottled crab* has a round body; the legs longer and larger than in other kinds; the claws red, except which the whole is mottled in a beautiful manner with red and white. These crabs inhabit the rocks hanging over the sea; they are the nimblest of all others, and run with surprising agility along the upright side of a rock, and under the rocks that hang horizontally below the water. This they are often necessitated to do for escaping the assaults of rapacious birds that pursue them. These crabs never go to land, but frequent mostly those parts of the promontories and islands of rocks in and near the sea, where by the continual and violent agitation of the waves against the rocks they are always wet, continually receiving the spray of the sea, which often washes them into it; but they instantly return to the rock again, not being able to live under water, and yet requiring more of that element than any of the crustaceous kinds that are not fish.

The *Rough-shelled crabs* are pretty large, and are commonly taken from the bottom of the sea in shallow water; the legs are small in proportion to the body; the two claws are remarkably large and flat. The whole shell is covered over with innumerable little tubercles like shagreen; the colour is brown, variously stained with purple.

The *Red-clawed crab* is of a small size and brown colour; it has two claws of unequal bigness, red at the ends; and eight legs, which are of less use to them than in other crabs, for when on the ground they crawl with a slow pace dragging their bodies along; but they are mostly seen grasping with their claws, and hanging to some sea-plant, or other marine substance.

The *Pea crab* has a round, smooth thorax, entire and blunt; its tail is of the size of the body, which commonly is of the bulk of a pea. It inhabits the mussel, and has justly acquired the repute of being poisonous. The swelling after eating of mussels is wholly constitutional; for one that is affected by it, hundreds remain uninjured. Crabs of this kind, or those allied to them, the ancients believed to have been the consentaneous inmates of the pinna, and other bivalves, which being too stupid to perceive the approach of their prey, were warned of it by their vigilant friend.

The *Common crab* has three notches in the front; five serrated teeth on each side; the claws elevated; the next joint toothed; the hind feet subulated; the

colour a dirty green, but red when boiled. It inhabits all our shores, and lurks under the algae, or burrows under the sand. It is sold, and eaten by the poor of our capitals.

The *Velvet crab* has the thorax quinque-dentated; the body is covered with short, brown, velvet-like pile, and the claws with minute tubercles; there are small spines round the top of the second joint; the hind legs are broadly ovated. This is among the species taken notice of by Aristotle on account of the broad feet, which, he says, assist them in swimming, as web-feet do the water-fowl. It inhabits the western coast of Anglesea.

The *Horrid crab* has a projecting bifurcated snout, the end diverging; the body is heart-shaped; and the claws and legs covered with long and sharp spines. It is a large species, and inhabits the rocks on the eastern coasts of Scotland.

The *Spider crab* has a bifid snout, a bristly throat, and a heart-shaped body, with several tubercles. The legs are slender, long, and subulated. It inhabits many of our shores, and is often covered with hairs.

From the 'Edinburgh New Philosophical Journal' we extract the following interesting account of the land-crabs of Jamaica by Alexander Barclay, Esq.:—"Crabs abound in the eastern part of Jamaica, at all seasons, but are considered to be best in the months, the names of which contain the letter R. They are most plentiful in May, the season at which they deposit their eggs, or *run*, as the negroes express it, and when the earth is literally covered with them. At this season it is impossible to keep them out of the houses, or even out of the bed-rooms, where, at one time scratching with their large claws, and at another rattling across the floor, they make a noise that would not a little astonish and alarm a stranger. Occasionally they will lodge themselves very snugly in a boot, and if a person puts his foot upon them inadvertently, he has quick intimation of the intruder, by a grasp of his nippers. For a few weeks in this season, they may be gathered in any quantities, and the negroes sometimes hurt themselves by making too free use of them. Even the hogs catch them, although not always with impunity, as a crab sometimes gets hold of one of them by the snout, from which he is not easily disengaged; and the terrified animal runs about squeaking in great distress. At other occasions, and when more valuable, they are caught by torch-light at night, and put into covered baskets. Crowds of negroes from the neighbouring plantations pass my house every evening with their torches and baskets, going to a crab wood on the other side, and return before midnight fully laden. Their baskets will contain about forty crabs, and the regular price is a five-penny piece, our smallest coin, equal to about 3½d. sterling, for five or six crabs. At this rate a negro will make 2s. 6d. currency in an evening; and the more improvident, who will not cultivate provision-grounds, depend, in some measure, upon catching crabs, and selling them to the others. A hundred plantains, usually sold at five shillings, will purchase from sixty to seventy crabs, and two of these eaten with plantains or yams, make an excellent meal. I have seen upwards of a hundred negroes pass my house in an evening, and return with their baskets not only full of crabs, but with quantities of them fastened on the tops of the baskets. I make but a moderate computation, when I suppose they must have had, at the very least, three thousand crabs. Almost every negro family has an old flour barrel, pierced with holes, in which their crabs are kept. They are fed with plantain skins, &c., and taken out and thrown into the pot as wanted.

"There is a great variety of crabs in Jamaica, of which two only are eaten. The black is the finest, and has ever been esteemed one of the greatest delicacies in the West Indies, not excepting even the

turtle. These live in the mountain-forest, on stony ground, and feed on the fallen dry leaves of the trees. The white crab, as it is called (although rather purple than white), used principally by the negroes, but by the white people also, is larger, and more resembles in taste the lobster of this country. These are amphibious, and are found in the low lands, principally in the woods, where, as I have already said, they are caught at night with torches. But they are numerous also in the cultivated fields, and in some of the low-lying estates frequently do considerable damage to the planters in dry weather, when vegetation is slow, by nipping off the blade of the young canes and corn, as it shoots through the ground. In situations of this kind, the negroes have a somewhat singular method of catching them; they know from the appearance of a crab-hole if there be a crab in it, and dig down with a hoe through the soft loam, till they come to water (about eighteen inches or two feet); and then close the hole firmly with a handful of dry grass. In this manner a negro will shut up two or three dozen of holes in a morning. About four hours after, he returns, and his prisoners being by this time *drunkened* (half-drowned), they tumble out along with the plug of grass, and are caught. In the year 1811, there was a very extraordinary production of black crabs in the eastern parts of Jamaica. In the month of June or July of that year, I forget which, the whole district of Manchioneal (where the great chain of the Blue mountains, extending from west to east, through the centre of the island, terminates on the east coast) was covered with countless millions of these creatures swarming from the sea to the mountains. Of this singular phenomenon, I was myself an eye-witness, having had occasion to travel through that district at the time. On ascending Quahill, from the vale of Plantain-garden river, the road appeared of a reddish colour, as if strewed with brick-dust. I dismounted from my horse to examine the cause of so unusual an appearance, and was not a little astonished to find that it was owing to myriads of young black crabs, about the size of the nail of a man's finger, crossing the road, and moving at a pretty pace direct for the mountains. I was concerned to think of the destruction I was causing in travelling through such a body of useful creatures, as I fancied that every time my horse put down a foot, it was the loss of at least ten lives. I rode along the coast, a distance of about fifteen miles, and found it nearly the same the whole way, only that in some places they were more numerous, and in others less so. Returning the following day, I found the road still covered with them the same as the day before. How have they been produced in such numbers, or, where are they come from?—were questions that everybody asked, and no one could answer. It is well known the crabs deposit their eggs once a year, and in the month of May; but, except on this occasion, though living on the coast, I never saw a dozen of young crabs together, and here were millions of millions covering the earth for miles along a large extent of sea-coast. No unusual number of old crabs had been observed that season; and it is worthy of remark, that this prodigious multitude of young ones were moving from a rock-bound shore, formed by inaccessible cliffs, the abode of sea-birds, and against which the waves of the sea were constantly dashed by the trade-wind blowing directly upon them. That the old crabs should be able to deposit their eggs in such a part of the coast (if that, as would appear, is the habit of the animal) is not a little extraordinary. No person in Jamaica, so far as I know or have heard, ever saw such a sight, or any thing of the kind, but on that occasion: and I have understood, that since 1811, black crabs have been more abundant farther into the interior of the island than they were ever known before."

CHAP. III.

OF THE TORTOISE AND ITS KINDS.

HAVING described the lobster and the crab as animals in some measure approaching to the insect tribes, it will appear like injustice to place the Tortoise among the number, that from its strength, its docility, and the warm red blood that is circulating in its veins, deserves to be ranked even above the fishes. But as this animal is covered, like the lobster, with a shell; as it is of an amphibious nature, and brings forth its young from the egg without hatching; we must be content to degrade it among animals that in every respect it infinitely surpasses.

Tortoises are usually divided into those that live upon land, and those that subsist in the water; and use has made a distinction even in the name; the one being called Tortoises, the other Turtles. However, Seba has proved that all tortoises are amphibious; that the land-tortoise will live in the water, and that the sea-turtle can be fed upon land. A land-tortoise was brought to him that was caught in one of the canals of Amsterdam, which he kept for half-a-year in his house, where it lived very well contented in both elements. When in the water, it remained with its head above the surface; when placed in the sun, it seemed delighted with its beams, and continued immoveable while it felt their warmth. The difference, therefore, in these animals, arises rather from their habits than their conformation; and, upon examination, there will be less variety found between them than between birds that live upon land, and those that swim upon the water.¹

Yet, though nature seems to have made but few distinctions among these animals, as to their conformation, yet, in their habits, they are very dissimilar; as these result from different qualities of their food, and the different sorts of enemies they have to avoid or encounter. I will therefore exhibit their figure and conformation under one common description, by which their slight differences will be more obvious; and then I will give a separate history of the manners of each, as naturalists and travellers have taught us.

All tortoises, in their external form, pretty much resemble each other; their outward covering being composed of two great shells, the one laid upon the other, and only touching at the edges: however, when we come to look closer we

shall find that the upper shell is composed of no less than thirteen pieces, which are laid flat upon the ribs, like the tiles of a house, by which the shell is kept arched and supported. The shells both above and below that, which seem, to an inattentive observer, to make each but one piece, are bound together at the edges by very strong and hard ligaments, yet with some small share of motion. There are two holes at either edge of this vaulted body; one for a very small head, shoulders, and arms, to peep through; the other at the opposite edge, for the feet and the tail. These shells the animal is never disengaged from; and they serve for its defence against every creature but man.

The tortoise has but a small head, with no teeth; having only two bony ridges in the place, serrated and hard. These serve to gather and grind its food; and such is the amazing strength of the jaws, that it is impossible to open them where they once have fastened. Even when the head is cut off, the jaws still keep their hold; and the muscles in death preserve a tenacious rigidity. Indeed, the animal is possessed of equal strength in all other parts of its body: the legs, though short, are inconceivably strong; and torpid as the tortoise may appear, it has been known to carry five men standing upon its back, with apparent ease and unconcern. Its manner of going forward is by moving its legs one after the other; and the claws with which the toes are furnished, sink into the ground like the nails of an iron-shod wheel, and thus assist its progression.

With respect to its internal parts, not to enter into minute anatomical disquisitions, it may not be improper to observe, that the blood circulates in this animal as in some cartilaginous fishes, and something in the manner of a child in the womb. The greatest quantity of the blood passes directly from the vena cava into the left ventricle of the heart, which communicates with the right ventricle by an opening; while the auricles only receive what the ventricles seem incapable of admitting. Thus the blood is driven by a very short passage through the circulation; and the lungs seem to lend only occasional assistance. From this conformation, the animal can subsist for some time, without using the lungs, or breathing; at least the lungs are not so necessary an instrument for driving on the circulation as with us.

Such is the general structure of this animal, whether found to live by land or water. With regard to the differences of these animals, the land-tortoise, from its habits of making use of its feet in walking, is much more nimble upon land than the sea-turtle: the land-tortoise, if thrown upon its back, by rocking and balancing its body, like a child rocking in a cradle, at last turns itself upon its face again; but the turtle, when once turned, continues without being able to move from the spot. In comparing the feet also of

¹ There are various different species of land-tortoise, of which it is unnecessary to enter into any description. The names bestowed on them generally indicate their habitat or appearance. These are—the Indian tortoise, the Radiated tortoise, the Tabular tortoise, the Geometrical tortoise, the Starred tortoise, the Leopard tortoise, the Kinixys tortoise, &c.—and the Emys tortoise, which latter term is employed to designate the various species that live habitually in fresh-water.—Ed.

these animals the nails upon the toes of one that has long been used to scratch for subsistence upon land, are blunt and worn; while those that have only been employed in swimming, are sharp and long, and have more the similitude of fins. The brain of the land-tortoise is but small; and yet it is three times as large as that of the turtle.—There is a difference also in the shape of their eggs, and in the passage by which they are excluded; for, in the land-tortoise, the passage is so narrow, that the egg conforms to the shape of the aperture, and though round when in the body, yet becomes much more oblong than those of fowls upon being excluded; otherwise they would never be able to pass through the bony canal by which they are protruded: on the contrary, the passage is wider in the turtle, and therefore its eggs are round. These are the most striking distinctions; but that which is most known is their size; the land-tortoise not exceeding three feet long, by two feet broad; the sea-turtle being sometimes from five to seven feet long. The size, however, is but a fallacious distinction; since land-tortoises, in some parts of India, grow to a very great magnitude; though probably not, as the ancients affirm, big enough for a single shell to serve for the covering of a house.

But if the different kinds of tortoises are not sufficiently distinguished by their figure, they are very obviously distinguishable by their methods of living. The land-tortoise lives in holes dug in the mountains, or near marshy lakes; the sea-turtle in cavities of rocks, and extensive pastures at the bottom of the sea. The tortoise makes use of its feet to walk with, and burrow in the ground; the turtle chiefly uses its feet in swimming, or creeping at the bottom.

The land-tortoise is generally found, as was observed above, from one foot to five feet long, from the end of the snout to the end of the tail; and from five inches to a foot and a half across the back. It has a small head, somewhat resembling that of a serpent: an eye without the upper lid; the under eyelid serving to cover and keep that organ in safety. It has a strong scaly tail, like the lizard. Its head the animal can put out and hide at pleasure, under the great pent-house of its shell; there it can remain secure from all attacks; there, defended on every side, it can fatigue the patience of the most formidable animal of the forest, that makes use only of natural strength to destroy it. As the tortoise lives wholly upon vegetable food, it never seeks the encounter; yet, if any of the smaller animals attempt to invade its repose, they are sure to suffer. The tortoise impreguably defended, is furnished with such a strength of jaw, that, though armed only with bony plates instead of teeth, wherever it fastens it infallibly keeps its hold, until it has taken out the piece.

Though peaceable in itself, it is formed for war in another respect, for it seems almost en-

dued with immortality. Nothing can kill it; the depriving it of one of its members is but a slight injury; it will live, though deprived of the brain; it will live, though deprived of its head. Redi informs us, that in making some experiments upon vital motion, he, in the beginning of November, took a land-tortoise, made a large opening in its skull, and drew out all the brain, washed the cavity, so as not to leave the smallest part remaining, and then leaving the hole open, set the animal at liberty. Notwithstanding this, the tortoise marched away without seeming to have received the smallest injury; only it shut the eyes, and never opened them afterwards. Soon after the hole in the skull was seen to close; and in three days, there was a complete skin covering the wound. In this manner the animal lived without a brain, for six months; walking about unconcernedly, and moving its limbs as before. But the Italian philosopher, not satisfied with this experiment, carried it still farther; for he cut off the head, and the animal lived twenty-three days after its separation from the body. The head also continued to rattle the jaws, like a pair of castanets, for above a quarter of an hour.

Nor are these animals less long-lived than difficult in destroying. Tortoises are commonly known to exceed eighty years old; and there was one kept in the Archbishop of Canterbury's garden, at Lambeth, that was remembered above a hundred and twenty. It was at last killed by the severity of a frost, from which it had not sufficiently defended itself in its winter retreat, which was a heap of sand at the bottom of the garden.

The usual food of the land-tortoise seems not so nourishing as to supply this extraordinary principle of vitality. It lives upon vegetables in its retreats in the mountains or the plain; and seldom makes its prey of snails or worms, but when other food is not found in grateful plenty. It is fond also of fruits; and when the forest affords them, is generally found not far from where they grow. As it can move but slowly, it is not very delicate in the choice of its food; so that it usually fills itself with whatever offers. Those that are kept in a domestic state will eat anything; leaves, fruits, corn, bran, or grass.

From the smallness of its brain, and the slowness of its motion, it obviously appears to be a torpid heavy animal, requiring rest and sleep; and, in fact, it retires to some cavern to sleep for the winter. I already observed that its blood circulated through the heart by a short passage; and that it did not, as anatomists express it, go through the great circulation. With us, and quadrupeds, the blood goes from the veins to the heart; and from the heart it is sent to be spread over the lungs; from the lungs it returns to the heart again; and from thence it goes to the arteries to be distributed through the whole body. But its passage in the tortoise is much shorter;

for, from the veins it goes to the heart; then leaving the lungs entirely out of its course, it takes a short cut, if I may so say, into the beginning of the arteries, which send it round the animal frame. From hence we see the lungs are left out of the circulation; and, consequently, the animal is capable of continuing to live without continuing to breathe. In this it resembles the bat, the serpent, the mole, and the lizard; like them it takes up its dark residence for the winter; and, at that time, when its food is no longer in plenty, it happily becomes insensible to the want. Nor is it unmindful to prepare its retreat, and make it as convenient as possible; it is sometimes buried two or three feet in the ground, with its hole furnished with moss, grass, and other substances, as well to keep the retreat warm, as to serve for food, in case it should prematurely awake from its state of stupefaction. But it must not be supposed, that, while it is thus at rest, it totally discontinues to breathe; on the contrary, an animal of this kind, if put into a close vessel, without air, will soon be stifled; though not so readily as in a state of vigour and activity.

From this dormant state the tortoise is awakened by the genial return of spring; and is thought not to be much wasted by its long confinement. To animals that live a hundred and fifty years, a sleep of six months is but as the nap of a night. All the actions of these long-lived creatures seem formed upon a scale answering the length of their existence; their slumbers are for a season; their motions are slow, and require time in every action; even the act of procreation, which among other animals is performed in a very few minutes, is with them the business of days. About a month after their enlargement from a torpid state, they prepare to transmit their posterity; and both continue joined for near a month together. The eggs of the female are contained in the ovary, above the bladder, which is extremely large; and these are, before their exclusion, round and naked, with some spots of red; after they are laid, however, they assume another form, being smaller and longer than those of a hen. This alteration in the figure of the eggs most probably proceeds from the narrowness of the bony passage through which they are excluded. Swammerdam, who compared the size of the eggs taken out of this animal's body with the diameter of the passage through which they were excluded, was of opinion that the bones themselves separated from each other, and closed again; but, in my opinion, it is more probable to suppose, that the eggs, and not the bones, alter their form. Certain it is, that they are round in the body, and that they are oval upon being protruded.

The eggs of all the tortoise kind, like those of birds, are furnished with a yolk and a white; but the shell is different, being somewhat like those soft eggs that hens exclude before their

time: however, this shell is much thicker and stronger, and is a longer time in coming to maturity in the womb. The land-tortoise lays but a few in number, if compared to the sea-turtle, who deposits from a hundred and fifty to two hundred in a season.

The amount of the land-tortoise's eggs I have not been able to learn; but, from the scarceness of the animal, I am apt to think they cannot be numerous. When it prepares to lay, the female scratches a slight depression in the earth, generally in a warm situation, where the beams of the sun have their full effect; there depositing her eggs, and covering them with grass and leaves, she forsakes them, to be hatched by the heat of the season. The young tortoises are generally excluded in about twenty-six days; but, as the heat of the weather assists, or its coldness retards incubation, sometimes it happens that there is a difference of two or three days. The little animals no sooner leave the egg than they seek for their provision, entirely self-taught; and their shell, with which they are covered from the beginning, expands and grows larger with age. As it is composed of a variety of pieces, they are all capable of extension at their sutures, and the shell admits of increase in every direction. It is otherwise with those animals, like the lobster, whose shell is composed all of one piece, that admits of no increase; which, when the tenant is too big for the habitation, must burst the shell, and get another. But the covering of the tortoise grows larger in proportion as the internal parts expand; in some measure resembling the growth of the human skull, which is composed of a number of bones, increasing in size in proportion to the quantity of the brain. All tortoises, therefore, as they never change their shell, must have it formed in pieces; and though, in some that have been described by painters or historians, these marks have not been attended to, yet we can have no doubt that they are general to the whole tribe.

It is common enough to take these animals into gardens, as they are thought to destroy insects and snails in great abundance. We are even told that in hot countries they are admitted into a domestic state, as they are great destroyers of bugs. How so large and heavy an animal is capable of being expert at such petty prey is not easy to conceive; but I have seen several of them about gentlemen's houses, that, in general, appear torpid, harmless, and even fond of employment. Children have sometimes got upon the back of a tortoise; and such was the creature's strength, that it never seemed overloaded, but moved off with its burden to where it expected to be fed, but would carry them no further. In winter they regularly find out a place to sleep in; but in those warm countries in which the tortoise is found larger, and in greater plenty than in Europe, they live without retiring, the whole year round.

The Sea-tortoise, or Turtle, as it is now called, is generally found larger than the former. This element is possessed with the property of increasing the magnitude of those animals, which are common to the land and the ocean. The sea pike is larger than that of fresh-water; the sea bear is larger than that of the mountains; and the sea-turtle exceeds the land-tortoise in the same proportion. It is of different magnitudes, according to its different kinds; some turtles being not above fifty pounds weight, and some above eight hundred.

The Great Mediterranean turtle (or Coriaceous turtle) is the largest of the turtle kind with which we are acquainted. It is found from five to eight feet long, and from six to nine hundred pounds weight. But, unluckily, its utility bears no proportion to its size; as it is unfit for food, and sometimes poisons those who eat it. The shell also, which is a tough strong integument, resembling a hide, is unfit for all serviceable purposes. One of these animals was taken in the year 1729, at the mouth of the Loire, in nets that were not designed for so large a capture. This turtle, which was of enormous strength, by its own struggles involved itself in the nets in such a manner as to be incapable of doing mischief: yet, even thus shackled, it appeared terrible to the fishermen, who were at first for flying; but finding it impotent, they gathered courage to drag it on shore, where it made a most horrible bellowing; and when they began to knock it on the head with their gaffs, it was to be heard at half-a-mile's distance. They were still farther intimidated by its nauseous pestilential breath, which so powerfully affected them, that they were near fainting.—This animal wanted but four inches of being eight feet long, and was above two feet over: its shell more resembled leather than the shell of a tortoise; and, unlike all other animals of this kind, it was furnished with teeth in each jaw, one rank behind another, like those of a shark: its feet also, different from the rest of this kind, wanted claws; and the tail was quite disengaged from the shell, and fifteen inches long, more resembling that of a quadruped than a tortoise. This animal was then unknown upon the coasts of France, and was supposed to have been brought into the European seas, in some India ship that might be wrecked upon her return. Since that, however, two or three of these animals have been taken upon the coasts; two in particular upon those of Cornwall, in the year 1756, the largest of which weighed eight hundred pounds; and one upon the Isle of Rhe, but two years before, that weighed between seven and eight hundred. One, most probably of this kind also, was caught about thirty years ago near Scarborough, and a good deal of company was invited to feast upon it: a gentleman, who was one of the guests, told the company that it was a Mediterranean turtle, and not wholesome; but a person, who was willing to satisfy his appetite

at the risk of his life, ate of it: he was seized with a violent vomiting and purging; but his constitution overpowered the malignity of the poison.

These are a formidable and useless kind, if compared to the turtle caught in the South seas and the Indian ocean. These are of different kinds; not only unlike each other in form, but furnishing man with very different advantages. They are usually distinguished by sailors into four kinds; the Trunk turtle, the Loggerhead, the Hawksbill, and the Green turtle.

The Trunk turtle is commonly larger than the rest, and its back higher and rounder. The flesh of this is rank, and not very wholesome.

The Loggerhead is so called from the largeness of its head, which is much bigger in proportion than that of the other kinds. The flesh of this also is very rank, and not eaten but in case of necessity.²

The Hawksbill turtle (or Imbricated turtle) is the least of the four, and has a long and small mouth, somewhat resembling the bill of a hawk. The flesh of this also is very indifferent eating; but the shell serves for the most valuable purposes. This is the animal that supplies the tortoise-shell, of which such a variety of beautiful trinkets are made. The substance of which the shells of other turtle are composed is thin and porous; but that of the hawksbill is firm, and when polished, is beautifully marbled. They generally carry about three pounds; but the largest of all, six pounds. The shell consists, as in all the kind, of thirteen leaves or plates, of which eight are flat, and five hollow. They are raised and taken off by means of fire, which is made under the shell after the flesh is taken out. As soon as the heat affects the leaves, they start from

² Loggerhead turtles inhabit the seas about the West India islands; they are also found in the Mediterranean, but particularly about the coasts of Italy and Sicily. In some seas they are more numerous than the green turtles, and being more strong, they occasionally make much longer voyages. They are often found in the ocean, at a distance of more than eight hundred leagues from land. One of them was seen by Catesby, sleeping on the surface of the water, in latitude 30 degrees north, apparently about midway betwixt the Azores and the Bahama islands, and these were the nearest possible land. These animals are excessively bold and fierce. When attacked they vigorously defend themselves, both with their mouth and paws, against the assailants; and it is extremely difficult to make them quit any hold which they happen to take with their jaws: so powerful are these, that the animals are able to divide even very strong substances by means of them. Aldrovandus assures us, that on offering a thick walking-stick to the gripe of a loggerhead turtle, which he saw publicly exhibited at Bologna, the animal bit it in two in an instant. The loggerheads are not, like the green turtles, contented with marine plants; their principal food is shell-fish, which their strong beak enables them, without difficulty, to tear from the rocks, and break to pieces; and their voracity is said to be such, that in some countries, it leads them to attack even young crocodiles, which they often mutilate of their limbs or tail.—Ed.

the ribs, and are easily raised with the point of a knife. By being scraped and polished on both sides, they become beautifully transparent, or are easily cast into what form the workman thinks proper, by making them soft and pliant in warm water, and then screwing them in a mould, like a medal: however, the shell is most beautiful before it undergoes this last operation.

But of all animals of the tortoise kind, the Green turtle is the most noted and the most valuable.³ The delicacy of its flesh, and its nutritive qualities, together with the property of being easily digested, were, for above a century, known only to our seamen, and the inhabitants of the coasts where they were taken. It was not till by slow degrees the distinction came to be made

³ This animal may be considered as one of the most useful productions of equatorial climates. On distant shores it furnishes to navigators an aliment equally agreeable, abundant, and salutiferous, and an assured remedy against the ravages of scurvy. The flesh and broth of turtle are recommended in a number of morbid affections, as in consumption of the lungs, inveterate syphilis, and a variety of cutaneous affections. The fat is of a deep green, but it is very finely flavoured. Leguat informs us, that, in the Island Rodriguez, the fat of the tortoises is so highly coloured, that people at first were afraid to eat it, and that it communicates to the urine the tint of emerald. The turtles of Batavia are not in much estimation. In Cook's Voyages we learn, that those of the river Endeavour, in New Holland, are very good. There is more or less a musky flavour about the green turtles, according to the season in which they are caught. It would appear that, under certain circumstances, and in certain latitudes, these animals possess pernicious qualities. At the time of the voyage of Commodore Anson, in 1740, the Spaniards and Americans of the western coasts of Mexico, near Panama, regarded their flesh as poisonous. Quere, whether the species of which we are now writing was the one which they thus stigmatized? Be this as it may, it is certain that in the European colonies, in the Antilles, and at the Isle of France, they are in the highest estimation. In Jamaica they are even preserved in parks; and their flesh is sold in the shops at a less price than that of beef and mutton. From this last island in particular is London supplied with immense quantities of this luxurious food. It would be quite superfluous to descend on the enthusiastic veneration in which turtle soup is held by English aldermen.

The turtles on board ship are kept in puncheons of salt water, which is changed every four or five days. A hole, about eight inches square, is made in the bulge of the puncheon, to admit air and food consisting of chopped plantain stalks and fowls' entrails; but many turtles never eat any thing during the whole voyage. Turtles will sometimes weigh more at their being landed here than when shipped in the West Indies; others, again, fall off considerably; but much depends upon the weather, and attention to changing the water frequently. The price of turtle, in Jamaica, is the same as that of beef. Sailors on board ships bound to Honduras, for mahogany, make an agreement with the captain that they shall not be obliged to eat turtle more than two or three times a-week. The eggs of the turtle are globular, the shell is soft like parchment, and is readily indented by pressure: although not unpalatable, many people do not like them, especially at first eating.—Ed.

between such as were malignant and such as were wholesome. The controversies and contradictions of our old travellers were numerous upon this head: some asserting, that the turtle was delicious food; and others, that it was actual poison. Dampier, that rough seaman, who has added more to natural history than half of the philosophers that went before him, appears to be the first who informed us of their distinctions; and that, while the rest might be valuable for other purposes, the green turtle alone was chiefly prized for the delicacy of its flesh. He never imagined, however, that this animal would make its way to the luxurious tables of Europe; for he seems chiefly to recommend it as salted up for ship's provision, in case of necessity.

At present the turtle is very well known among us, and is become the favourite food of those that are desirous of eating a great deal without the danger of surfeiting. This is a property the flesh of the turtle seems peculiarly possessed of; and by the importation of it alive among us, gluttony is freed from one of its greatest restraints. The flesh of the turtle is become a branch of commerce; and therefore ships are provided with conveniences for supplying them with water and provision, to bring them over in health from Jamaica and other West India islands. This, however, is not always effected; for though they are very vivacious, and scarcely require any provision upon the voyage, yet, by the working of the ship, and their beating against the sides of the boat that contains them, they become battered and lean; so that to eat this animal in the highest perfection, instead of bringing the turtle to the epicure, he ought to be transported to the turtle.

This animal is called the green turtle, from the colour of its shell, which is rather greener than that of others of this kind. It is generally found about two hundred weight; though some are five hundred, and others not above fifty. Dampier tells us of one that was seen at Port-Royal, in Jamaica, that was six feet broad across the back; he does not tell us its other dimensions; but says that the son of Captain Roach, a boy about ten years old, sailed in the shell, as in a boat, from the shore to his father's ship, which was above a quarter of a mile from land. But this is nothing to the size of some turtles the ancients speak of. *Ælian* assures us, that the houses in the island of Taprobane are usually covered with a single shell. *Diodorus Siculus* tells us that a people neighbouring on Ethiopia, called the *Turtle-eaters*, coasted along the shore in boats made of the upper shell of this animal; and that in war, when they had eaten the flesh, the covering served them as a tent. In this account, *Pliny*, and all the rest of the ancients, agree; and, as they had frequent opportunities of knowing the truth, we are not lightly to contradict their testimony.

At present, however, they are not seen of such

amazing dimensions. We are told by Laet, that on the Isle of Cuba they grow to such a size, as that five men can stand on the back of one of them together; and what is more surprising still, that the animal does not seem overloaded, but will go off with them upon its back, with a slow steady motion, towards the sea.

They are found in the greatest numbers on the island of Ascension; where, for several years, they were taken to be salted to feed the slaves, or for a supply of ship's provision. Their value at present seems to be better known.

This animal seldom comes from the sea but to deposit its eggs, and now and then to sport in fresh-water. Its chief food is a submarine plant, that covers the bottom of several parts of the sea not far from the shore. There the turtles are seen, when the weather is fair, feeding in great numbers, like flocks of sheep, several fathoms deep, upon the verdant carpet below. At other times they go to the mouths of rivers; and they seem to find gratification in fresh-water. After some time thus employed, they seek their former stations; and when done feeding, they generally float with their heads above water, unless they are alarmed by the approach of hunters, or birds of prey, in which case they suddenly plunge to the bottom. They often seek their provision among the rocks, feeding upon moss and sea-weed; and it is probable will not disdain to prey upon insects and other small animals, as they are very fond of flesh when taken and fed for the table.

At the time of breeding, they are seen to forsake their former haunts and their food, and to take sometimes a voyage of nine hundred miles to deposit their eggs on some favourite shore. The coasts they always resort to upon these occasions are those that are low, flat, and sandy; for, being heavy animals, they cannot climb a bold shore; nor is any bed so proper as sand to lay their eggs on. They couple in March, and continue united till May; during a great part of which time they are seen locked together, and almost incapable of separation. The female seems passive and reluctant; but the male grasps her with his claws in such a manner, that nothing can induce him to quit his hold. It would seem that the grasp, as in frogs, is in some measure convulsive, and that the animal is unable to relax its efforts.

When the time for laying approaches, the female is seen towards the setting of the sun drawing near the shore, and looking earnestly about her, as if afraid of being discovered. When she perceives any person on shore, she seeks for another place; but if otherwise, she lands when it is dark, and goes to take a survey of the sand where she designs to lay. Having marked the spot, she goes back without laying, for that night, to the ocean again; but the next night returns to deposit a part of her burden. She begins by working and digging in the sand with her fore-

feet till she has made a round hole, a foot broad and a foot and a half deep, just at the place a little above where the water reaches highest. This done, she lays eighty or ninety eggs at a time, each as big as a hen's egg, and as round as a ball. She continues laying about the space of an hour; during which time, if a cart were driven over her, she would not be induced to stir. The eggs are covered with a tough white skin, like wetted parchment. When she has done laying, she covers the hole so dexterously, that it is no easy matter to find the place; and those must be accustomed to the search to make the discovery. When the turtle has done laying, she returns to the sea, and leaves her eggs to be hatched by the heat of the sun. At the end of fifteen days she lays about the same number of eggs again; and at the end of another fifteen days she repeats the same; three times in all, using the same precautions every time for their safety.

In about twenty-four or twenty-five days after laying, the eggs are hatched by the heat of the sun; and the young turtles being about as big as quails, are seen bursting from the sand, as if earth-born, and running directly to the sea, with instinct only for their guide; but, to their great misfortune, it often happens that, their strength being small, the surges of the sea, for some few days, beat them back upon the shore. Thus exposed, they remain a prey to thousands of birds that then haunt the coasts; and these stooping down upon them carry off the greatest part, and sometimes the whole brood, before they have strength sufficient to withstand the waves, or dive to the bottom. Helbigius informs us, that they have still another enemy to fear, which is no other than the parent that produced them, that waits for their arrival at the edge of the deep, and devours as many as she can. This circumstance, however, demands further confirmation; though nothing is more certain than that the crocodile acts in the same unnatural manner.⁴

When the turtles have done laying, they then return to their accustomed places of feeding. Upon their outset to the shore where they breed, they are always fat and healthy; but upon their return, they are weak, lean, and unfit to be eaten. They are seldom, therefore, molested upon their retreat; but the great art is to seize them when arrived, or to intercept their arrival. In these uninhabited islands, to which the green turtle chiefly resorts, the men that go to take them land about night-fall, and without making any noise, (for these animals, though without any external opening of the ear, hear very distinctly, there being an auditory conduit that opens into the mouth,) lie close while they see the female

⁴ This account of the turtle's preying upon its young is altogether fabulous. These animals feed entirely upon those vast masses of marine plants cast upon the coasts, and probably upon the numerous living substances floating on shore with these plants.—ED.

turtle coming on shore. They let her proceed to her greatest distance from the sea; and then, when she is most busily employed in scratching a hole in the sand, they sally out and surprise her. Their manner is to turn her upon her back, which utterly incapacitates her from moving; and yet, as the creature is very strong, and struggles very hard, two men find it no easy matter to lay her over. When thus secured they go to the next; and in this manner, in less than three hours, they have been known to turn forty or fifty turtles, each of which weighs from a hundred and fifty to two hundred pounds. Labat assures us, that when the animal is in this helpless situation, it is heard to sigh very heavily, and even to shed tears.

At present, from the great appetite that man has discovered for this animal, they are not only thinned in their numbers, but are also grown much more shy. There are several other ways, therefore, contrived to take them. One is, to seize them when coupled together, at the breeding season, when they are very easily approached, and as easily seen; for these animals, though capable of living for some time under water, yet rise every eight or ten minutes to breathe. As soon as they are thus perceived, two or three people draw near them in a canoe, and slip a noose either round their necks or one of their feet. If they have no line, they lay hold of them by the neck, where they have no shell, with their hands only; and by this means they usually catch them both together. But sometimes the female escapes, being more shy than the male.

Another way of taking them is by the harpoon, either when they are playing on the surface of the water, or feeding at the bottom; when the harpoon is skilfully darted, it sticks fast in the shell of the back; the wood then disengages from the iron, and the line is long enough for the animal to take its range; for if the harpooner should attempt at once to draw the animal into his boat till it is weakened by its own struggling, it would probably get free. Thus the turtle struggles hard to get loose, but all in vain; for they take care the line fastened to the harpoon shall be strong enough to hold it.

There is yet another way, which, though seemingly awkward, is said to be attended with very great success. A good diver places himself at the head of the boat; and when the turtles are observed, which they sometimes are in great numbers, asleep on the surface, he immediately quits the vessel, at about fifty yards' distance, and keeping still under water, directs his passage to where the turtle was seen, and, coming up beneath, seizes it by the tail; the animal awaking struggles to get free: and by this both are kept at the surface until the boat arrives to take them in.

SUPPLEMENTARY NOTE.—*The Land Tortoise.*

Mr. White, in his 'History of Selborne,' gives the following interesting account of a land-tortoise:—
 "A land-tortoise, which has been kept for thirty years in a little walled court belonging to the house where I am now visiting, retires under ground about the middle of November, and comes forth again about the middle of April. When it first appears in the spring it discovers very little inclination towards food, but in the height of summer grows voracious, and then as the summer declines its appetite declines; so that for the last six weeks in autumn it hardly eats at all. Milky plants, such as lettuces, dandelions, sowthistles, are its favourite dish. In a neighbouring village one was kept till, by tradition, it was supposed to be a hundred years old—an instance of vast longevity in such a poor reptile! On the 1st of November I remarked that the old tortoise began first to dig the ground, in order to the forming of its hybernaculum, which it had fixed on just beside a great tuft of hepaticas. It scrapes into the ground with its fore-feet, and throws it up over its back with its hind; but the motion of its legs is ridiculously slow, little exceeding the hour-hand of a clock, and suitable to the composure of an animal said to be a whole month in performing one feat of copulation. Nothing can be more assiduous than this creature night and day in scooping the earth; and forcing its great body into the cavity; but as the noons of that season proved unusually warm and sunny, it was continually interrupted, and called forth, by the heat in the middle of the day; and though I continued there till the 13th of November, yet the work remained unfinished. Harsher weather, and frosty mornings, would have quickened its operations. No part of its behaviour ever struck me more than the extreme timidity it always expresses with regard to rain; for though it has a shell that would secure it against the wheel of a loaded cart, yet does it discover as much solicitude about rain as a lady dressed in her best attire, shuffling away on the first sprinklings and running its head up in a corner. If attended to, it becomes an excellent weather-glass; for as sure as it walks elate, and as it were on tiptoe, feeding with great earnestness in a morning, so sure will it rain before night. It is totally a diurnal animal, and never pretends to stir after it becomes dark. The tortoise, like other reptiles, has an arbitrary stomach, as well as lungs; and can refrain from eating as well as breathing for a great part of the year. When first awakened it eats nothing; nor again in the autumn before it retires; through the height of the summer it feeds voraciously, devouring all the food that comes in its way. I was much taken with its sagacity in discerning those that do it kind offices; for as soon as the good old lady comes in sight who has waited on it for more than thirty years, it hobbles towards its benefactress with awkward alacrity; but remains inattentive to strangers. Thus not only 'the ox knoweth his owner, and the ass his master's crib,' but the most abject reptile and torpid of beings distinguishes the hand that feeds it, and is touched with the feeling of gratitude. Though he loves warm weather, he avoids the hot sun; because his thick shell, when once heated, would, as the poet says of solid armour, 'scald with safety.' He therefore spends the more sultry hours under the umbrella of a large cabbage-leaf, or amidst the waving forests of an asparagus bed. But as he avoids the heat in summer, so, in the decline of the year, he improves the faint autumnal beams, by getting within the reflection of a fruit-wall; and, though he never has read that plains inclining to the horizon receive a greater share of warmth, he inclines his shell, by tilting it against

the wall, to collect and admit every feeble ray. Pitiable seems the condition of this poor embarrassed reptile: to be cased in a suit of ponderous armour, which he cannot lay aside; to be imprisoned, as it were, within his own shell, must preclude, as we should suppose, all activity and disposition for enterprise. Yet there is a season of the year (usually the beginning of June) when his exertions are remarkable. He then walks on tiptoe, and is stirring by five in the morning; and, traversing the garden, examines every wicket and interstice in the fences, through which he will escape if possible; and often has eluded the care of the gardener, and wandered to some distant field. The motives that impel him to undertake these rambles seem to be of the amorous kind; his fancy then becomes intent on sexual attachments, which transport him beyond his usual gravity, and induce him to forget for a time his ordinary solemn deportment."

The following are some remarkable instances of longevity recorded by Mr. Murray, in his 'Experimental Researches':—In the Library of Lambeth-palace is the shell of a land-tortoise, brought there about the year 1623, it lived until 1730, a period of 107 years. Another was placed in the garden of the episcopal palace of Fulham, by Bishop Laud, in 1625, and died in 1753—128 years: the age at which these were placed in the gardens was of course unknown. Another is mentioned 220 years, and one in Exeter Change 800; these latter, however, do not seem well authenticated, though there can be no doubt of the period of their existence. Mr. Murray has added some very interesting information regarding the habits of a tortoise kept at Peterborough:—

"From a document belonging to the archives of the cathedral, called the Bishop's-barn, it is well ascertained that the tortoise at Peterborough must have been about 220 years old. Bishop Marsh's predecessor in the see of Peterborough had remembered it above sixty years, and could recognise no visible change. He was the seventh bishop who had worn the mitre during its sojourn there. If I mistake not, its sustenance and abode were provided for in this document. Its shell was perforated, in order to attach it to a tree, &c., to limit its ravages among the strawberry borders. The animal had its antipathies and predilections. It would eat endive, green pease, and even the leek; while it positively rejected asparagus, parsley, and spinage. In the early part of the season, its favourite pabulum were the flowers of the dandelion, of which it would devour twenty at a meal; and lettuce, of the latter a good sized one at a time; but if placed between lettuce and the flowers of the dandelion, it would forsake the former for the latter. It was also partial to the pulp of an orange, which it sucked greedily. About the latter end of June, (discerning the times and the seasons,) it looked out for fruit, when its former choice was forsaken. It ate currants, raspberries, pears, apples, peaches, nectarines, &c., the riper the better, but would not taste cherries. Of fruits, however, the strawberry and gooseberry were the most esteemed: it made great havoc among the strawberry borders, and would take a pint of gooseberries at intervals. The gardener told me it knew him well, the hand that generally fed it, and would watch him attentively at the gooseberry bush, where it was sure to take its station while he plucked the fruit. I could not get it to take the root of the dandelion, nor indeed any root I offered it, as that of the carrot, turnip, &c. All animal food was discarded, nor would it take any liquid, at least neither milk nor water; and when a leaf was moist, it would shake it to expel the adhering wet. This animal moved with apparent ease, though pressed by a weight of 18 stones; itself weighed 13½ pounds. In cloudy weather it would scoop out a cavity, generally in a southern exposure,

where it reposed, torpid and inactive, until the genial influence of the sun roused it from its slumber. When in this state the eyes were closed, and the head and neck a little contracted, though not drawn within the shell. Its sense of smelling was so acute, that it was roused from its lethargy if any person approached even at a distance of twelve feet. About the beginning of October, or latter end of September, it began to immure itself, and had for that purpose, for many years, selected a particular angle of the garden; it entered in an inclined plane, excavating the earth in the manner of the mole; the depth to which it penetrated varied with the character of the approaching season, being from one to two feet, according as the winter was mild or severe. It may be added, that for nearly a month prior to this entry into its dormitory, it refused all sustenance whatever. The animal emerged about the end of April, and remained for at least a fortnight before it ventured on taking any species of food. Its skin was not perceptibly cold; its respiration, entirely effected through the nostrils, was languid. I visited the animal, for the last time, on the 9th June, 1813, during a thunder-storm; it then lay under the shelter of a cauliflower, and apparently torpid."

CHAP. IV.

OF THE SHELL OF TESTACEOUS FISHES.

ONE is apt to combine very dissimilar objects in the same group, when hurried into the vortex of method. No two animals are more unlike each other than the whale and the limpet, the tortoise and the oyster. Yet, as these animals must find some place in the picture of animated nature, it is best to let them rest in the station which the generality of mankind have assigned them; and as they have been willing to give them all from their abode the name of fishes, it is wisest in us to conform.

But before I enter into a history of shell-fish, it may not be improper to observe, that naturalists, who have treated on this part of history, have entirely attended to outward forms; and, as in many other instances, forsaking the description of the animal itself, have exhausted all their industry in describing the habitation. In consequence of this radical error, we have volumes written upon the subject of shells, and very little said on the history of shell-fish. The life of these industrious creatures, that, for the most part, creep along the bottom, or immovably wait till driven as the waves happen to direct, is almost entirely unknown. The wreathing of the shells, or the spots with which they are tintured, have been described with a most disgusting prolixity; but their appetites and their combats, their escapes and humble arts of subsistence, have been utterly neglected.

As I have only undertaken to write the history of animated nature, the variety of shells, and their peculiar spots or blemishes, do not come within my design. However, the manner in which shells are formed is a part of natural

history connected with my plan, as it presupposes vital force or industry in the animal that forms them.

The shell may be considered a habitation supplied by nature. It is a hard stony substance, made up somewhat in the manner of a wall. Part of the stony substance the animal derives from outward objects, and the fluids of the animal itself furnish the cement. These united make that firm covering which shell-fish generally reside in till they die.

But, in order to give a more exact idea of the manner in which sea-shells are formed, we must have recourse to an animal that lives upon land, with the formation of whose shell we are best acquainted. This is the garden-snail, that carries its box upon its back, whose history Swammerdam has taken such endless pains to describe. As the manner of the formation of this animal's shell extends to that of all others that have shells, whether they live upon land or in the water, it will be proper to give it a place before we enter upon the history of testaceous fishes.

To begin with the animal in its earliest state, and trace the progress of its shell from the time it first appears—The instant the young snail leaves the egg, it carries its shell or its box on its back. It does not leave the egg till it is arrived at a certain growth, when its little habitation is sufficiently hardened. This beginning of the shell is not much bigger than a pin's head, but grows in a very rapid manner, having at first but two circumvolutions, for the rest are added as the snail grows larger. In proportion as the animal increases in size, the circumvolutions of the shell increase also, until the number of these volutes comes to be five, which is never exceeded.

The part where the animal enlarges its shell is at the mouth, to which it adds in proportion as it finds itself stinted in its habitation below. Being about to enlarge its shell, it is seen with its little teeth biting and clearing away the scaly skin that grows at the edges. It is sometimes seen to eat those bits it thus takes off; at other times it only cleans away the margin when covered with films, and then adds another rim to its shell.

For the purposes of making the shell, which is natural to the animal, and without which it could not live three days, its whole body is furnished with glands, from the orifices of which flows out a kind of slimy fluid, like small spider threads, which join together in one common crust or surface, and in time condense and acquire a stony hardness. It is this slimy humour that grows into a membrane, and afterwards a stony skin: nor can it have escaped any who have observed the track of a snail; that glistening substance which it leaves on the floor or the wall, is no other than the materials with which the animal adds to its shell, or repairs it when broken.

Now to exhibit in a more satisfactory manner the method in which the shell is formed—The snail bursts from its egg with its shell upon its back; the shell, though very simple, is the centre round which every succeeding convolution of the shell is formed, by new circles added to the first. As the body of the snail can be extended nowhere but to the aperture, the mouth of the shell only can, of consequence, receive augmentation. The substance of which the shell is composed is chiefly supplied by the animal itself, and is no more than a slimy fluid which hardens into bone. This fluid passes through an infinite number of little glands, till it arrives at the pores of the skin; but there it is stopped by the shell that covers the part below; and therefore is sent to the mouth of the shell, where it is wanted for enlargement. There the first layer of slime soon hardens; and then another is added, which hardens also, till in time the shell becomes as thick as is requisite for the animal's preservation. Thus every shell may be considered as composed of a number of layers of slime, which have entirely proceeded from the animal's own body.

But though this be the general opinion with regard to the formation of shells, I cannot avoid thinking there are still other substances beside the animal's own slime which go to the composition of its shell, or at least to its external coat, which is ever different from the internal. The substances I mean are the accidental concretions of earthy or saline parts, which adhere to the slimy matter upon its first emission.¹ By adopt-

¹ Our author is mistaken in supposing that any part of the shell is composed of extraneous matter. If such were the case, the same species of shell would often be found to differ in its composition and external appearance, whereas some species are so uniformly alike, that it is difficult to distinguish between two shells.

However varied in external character, shells differ very little in their chemical composition. They all consist of carbonate of lime united to a soft albuminous matter, and any variation that occurs in different shells is merely in the relative proportions of these constituent parts. Mr. Hatchett has divided shells into two classes, according to the proportion and state of their animal matter. The first class he names Porcellaneous shells, since they resemble porcelain, are usually of a compact texture, and have an enamelled surface, which is often finely variegated. The convolute, a tribe of univalve shells, afford good examples of this class. They consist of carbonate of lime, cemented together by so small a portion of albumen, that, when immersed in a dilute acid, the shell is completely dissolved, and not a sensible trace of it left behind. The shells belonging to the second class are usually covered with a strong epidermis, below which lies the shell in layers, and composed entirely of the substance well known by the name of Mother-of-pearl. They have been distinguished by the name of Mother-of-pearl shells. The fresh-water mussels, the oysters, the Haliotis, and pearly turbines, are examples of this class. When immersed in acids they effervesce, at first strongly, but gradually more and more feebly, till at last the emission of air-bubbles is scarcely perceptible. The acids take up only lime, and leave a number of thin membranous

ing this theory, we can more satisfactorily account for the various colours of the shell, which cannot be supposed to take its tincture from the animal's body, as is the usual opinion; for all the internal parts of the shell are but of one white colour; it is only the outermost layer of the shell that is so beautifully varied, so richly tintured with that variety of colours we behold in the cabinets of the curious. If the external coat be scaled off, as Mr. Argenville asserts, all the inner substance will be found but of one simple colouring; and consequently the animal's own juices can give only one colour; whereas we see some shells stained with a hundred.

The usual way of accounting for the different colouring of shells, which seems to me erroneous, is this: in the body of every one of these animals, several streaks are discerned of a different colour from the rest. "This variety," say they, "is an incontestable proof that the juices flowing from those parts will be also of a different hue; and will consequently tinge that part of the shell which their slime composes of a different colour." But this system, as was observed before, is overthrown by the fact, which discovers that only the outer surface of the shell is tinged; whereas by this it would have been coloured throughout; nay, by this system, the internal parts of the shell would be stained with the most vivid colouring, as being least exposed to the external injuries of the element where it is placed. But the truth is, the animal residing in the shell has none of these various colours thus talked of: its slime is a simple pellucid substance; and the only marblings which appear in its body, are the colour of the food, which is seen through its transparent intestines. We must, therefore, account for the various colouring of its shell upon a different principle.

If, as I said, we examine the cabinets of the curious, we shall find shells with various and beautiful colouring; we shall find them generally furnished with a white ground, tintured with red, yellow, brown, green, and several other shades and lovely mixtures, but never blue. Shells are of almost all colours but blue. The reason seems to be obvious; for blue is the colour which sea-water changes. A piece of silk, or a feather, of this colour, put into an infusion of salt, urine, or nitre, lose their tint entirely. Now may not this give us a hint with respect to the operation of Nature in colouring her shells? May we not from hence conclude, that sea-water is

substances, which still retain the form of the shell. These membranes have the properties of coagulated albumen. But the distinction between these two classes holds good only in extreme cases; for there are many shells which are intermediate, and stand on debatable ground. The compact bivalves dissolve in the menstruum entirely, as does also the common whelk (*Buccinum undatum*), but they are not properly porcellaneous; while the various land-snails leave an insoluble membrane, though they are not porcellaneous shells.—Ed.

efficacious in giving colour, or taking it away? That, to produce colour, the animal not only furnishes its juices, but the sea or the earth that mixture of substance which is to unite with them? Neither the animal slime alone, nor the external earthy or saline substances alone, could produce colours; but both united, produce an effect which neither, separately, was possessed of. Thus shells assume every colour but blue; and that sea-water, instead of producing, would be apt to destroy.

From hence, therefore, it appears, that the animal does not alone tincture its own shell; but that external causes co-operate in contributing to its beauty. It is probable that, from the nature of its food, or from other circumstances unknown to us, the external layers of its slime may be of different consistences; so as, when joined with the particles of earth or salt that are accidentally united with them from without, they assume various and beautiful hues. But the internal layers, which receive no foreign admixture, still preserve the natural colour of the animal, and continue white without any variation.

Thus far we see that the animal is not wholly the agent in giving beauty and colouring to its shell: but it seems otherwise with respect to its convolutions, its prominences, and general form. These entirely depend upon the art of the animal; or rather upon its instincts; which, in the same kinds, are ever invariable. The shell generally bears some rude resemblance to the body upon which it has been moulded. Thus, it is observable in all sea-shells, that if the animal has any tumour, or excrescence on its body, it creates likewise a swelling in that part of the incrustation to which it corresponds. When the animal begins to alter its position, and to make new additions to its apartments, the same protuberance which had raised the shell before in one part, swells it again at some little distance; by which means we see the same inequality, in a spiral line, all round the shell. Sometimes these tumours of the animal are so large, or so pointed, that those which rise over them in the incrustation appear like horns: after this the animal disengages itself from its first cavities; and then, by fresh evacuations, assumes a new set of horns; and so increases the number in proportion to its growth. If, on the other hand, the body happens to be channelled, the shell that covers it will be channelled likewise; if there be any protuberances in the body, which wind in a spiral line about it, the shell will likewise have its tumours and cavities winding round to the end.

In this manner, as the animals are of various forms, the shells exhibit an equal variety. Indeed, the diversity is so great, and the figures and colours so very striking, that several persons, with a kind of harmless indolence, have made the arrangement of them the study and the business of their lives. Those who consult their beauty alone, take care to have them polished,

and to have an external crust, or periosteum, as Swammerdam calls it, scoured off from their surfaces by spirit of salt. But there are others that, with more learned affectation, keep them exactly in the state in which they have been found, with their precious crust still round them. The expense men have sometimes been at, in making such collections, is amazing; and some shells, such as the Stairs-shell, or the Admiral-shell, are not more precious for their scarceness, than pearls are for their beauty. Indeed, it is the scarcity, and not the beauty of the object, that determines the value of all natural curiosities. Those shells that offer but little beauty to the ignorant are often the most precious; and those shells which an unlearned spectator would stop to observe with admiration, one accustomed to the visitation of cabinets would pass over with disdain.—These collections, however, have their use; not only by exhibiting the vast variety of Nature's operations, but also by exciting our curiosity to the consideration of the animals that form them. A mind that can find innocent entertainment in these humble contemplations is well employed; and, as we say of children, is kept from doing mischief. Although there may be nobler occupations than that of considering the convolutions of a shell, yet there may be some who want the ambition to aspire after such arduous pursuits; there may be some unfit for them; there may be some who find their ambition fully gratified by the praise which the collectors of shells bestow upon each other. Indeed, for a day or two, there is no mind that a cabinet of shells cannot furnish with pleasing employment. "What can be more gratifying," as Pliny says,² "than to view Nature in all her irregularities, and sporting in her variety of shells! Such a difference of colour do they exhibit! such a difference of figure! flat, concave, long, lunated, drawn round in a circle, the orbit cut in two! some are seen with a rising on the back, some smooth, some wrinkled, toothed, streaked, the point variously intorted, the mouth pointing like a dagger, folded back, bent inwards! all these variations, and many more, furnish at once novelty, elegance, and speculation."

With respect to the figure of shells, Aristotle has divided them into three kinds: and his method is, of all others, the most conformable to nature. These are, first, the *univalve*, or *turbinated*, which consist of one piece, like the box of a snail; secondly, the *bivalve*, consisting of two pieces, united by a hinge, like an oyster; and, thirdly, the *multivalve*, consisting of more than two pieces, as the Acorn-shell, which has not less than twelve pieces that go to its composition. All these kinds are found in the sea at different depths, and are valuable in proportion to their scarceness or beauty.

From the variety of the colours and figure of shells, we may pass to that of their place and

situation. Some are found in the sea; some in fresh-water rivers; some alive upon land; and a still greater quantity dead in the bowels of the earth. But wherever shells are found, they are universally known to be composed of one and the same substance. They are formed of an animal or calcareous earth, that ferments with vinegar and other acids, and that burns into lime, and will not easily melt into glass. Such is the substance of which they are composed; and of their spoils, many philosophers think that a great part of the surface of the earth is composed at present. It is supposed by them, that chalks, marls, and all such earths as ferment with vinegar, are nothing more than a composition of shells, decayed, and crumbled down to one uniform mass.

Sea-shells are either found in the depths of the ocean, or they are cast empty, and forsaken of their animals, upon shore. Those which are fished up from the deep, are called by the Latin name *Pelagii*; those that are cast upon shore are called *Littorales*. Many of the pelagii are never seen upon shore; they continue in the depths where they are bred; and we owe their capture only to accident. These, therefore, are the most scarce shells, and consequently the most valuable. The littorales are more frequent, and such as are of the same kind with the pelagii are not so beautiful. As they are often empty and forsaken, and as their animal is dead, and, perhaps, putrid in the bottom of the shell, they, by this means, lose the whiteness and the brilliancy of their colouring. They are not, unfrequently, also found eaten through, either by worms, or by each other; and they are thus rendered less valuable: but what decreases their price still more is, when they are scaled and worn by lying too long empty at the bottom, or exposed upon the shore. Upon the whole, however, sea-shells exceed either land or fossil-shells in beauty; they receive the highest polish, and exhibit the most brilliant and various colouring.

Fresh-water shells are neither so numerous, so various, nor so beautiful, as those belonging to the sea. They want that solidity which the others have; their *clavicle*, as it is called, is neither so prominent nor so strong; and not having a saline substance to tinge the surface of the shell, the colours are obscure. In fresh-water there are but two kinds of shells, namely, the bivalved and the turbinated.

Living land-shells are more beautiful, though not so various, as those of fresh-water; and some not inferior to sea-shells in beauty. They are, indeed, but of one kind, namely, the turbinated; but in that there are found four or five very beautiful varieties.

Of fossil, or, as they are called, *extraneous* shells, found in the bowels of the earth, there are great numbers, and as great a variety. In this class there are as many kinds as in the sea itself. There are found the turbinated, the bivalve, and

² Plin. ix. 33.

the multivalve kinds; and of all these, many, at present, are not to be found even in the ocean. Indeed, the number is so great, and the varieties so many, that it was long the opinion of naturalists, that they were merely the capricious productions of nature, and had never given retreat to animals whose habitations they resembled. They were found, not only of various kinds, but in different states of preservation; some had the shell entire, composed, as in its primitive state, of a white calcareous earth, and filled with earth, or even empty; others were found with the shell entire, but filled with a substance which was petrified by time; others, and these in great numbers, were found with the shell entirely mouldered away, but the petrified substance that filled it still exhibiting the figure of the shell; others still, that had been lodged near the earth or stone, impressed their print upon these substances, and left the impression, though they themselves were decayed: lastly, some shells were found half mouldered away, their parts scaling off from each other in the same order in which they were originally formed.³ However, these different stages of the shell, and even their fermenting with acids, were at first insufficient to convince those who had before assigned them a different origin. They were still considered as accidentally and sportively formed, and deposited in the various repositories where they were found, but no way appertaining to any part of animated nature. This put succeeding inquirers upon more minute researches; and they soon began to find, that often, where they dug up petrified shells or teeth, they could discover the petrified remains of some other bony parts of the body. They found that the shells, which were taken from the earth, exhibited the usual defects and mischances which the same kind are known to receive at sea. They showed them not only tinctured with a salt-water crust, but pierced in a peculiar manner by the sea-worms, that make the shells of fishes their favourite food. These demonstrations were sufficient, at last, to convince all but a few philosophers, who died away, and whose erroneous systems died with them.

Every shell, therefore, wherever it is found, is now considered as the spoil of some animal, that once found shelter therein. It matters not by what unaccountable means they may have wandered from the sea; but they exhibit all, and the most certain marks of their origin. From their numbers and situation we are led to conjecture, that the sea reached the places where they are found; and from their varieties we learn how little we know of all the sea contains at present; as the earth furnishes many kinds which our most exact and industrious shell-collectors have not been able to fish up from the deep. It is most probable that thousands of different forms

³ Fossil shells all differ from those of the present day, so that it would appear that the shells of a former world have become totally extinct.—ED.

still remain at the bottom unknown; so that we may justly say with the philosopher, *Ea quæ scimus sunt pars minima eorum quæ ignoramus.*

It is well, however, for mankind, that the defect of our knowledge on this subject is, of all parts of learning, that which may be most easily dispensed with. An increase in the number of shells would throw but very few lights upon the history of the animals that inhabit them. For such information we are obliged to those men who contemplated something more than the outside of the objects before them. To Reaumur we are obliged for examining the manners of some with accuracy; but to Swammerdam for more. In fact, this Dutchman has lent an attention to those animals that almost exceeds credibility: he has excelled even the insects he dissected, in patience, industry, and perseverance. It was in vain that this poor man's father dissuaded him from what the world considered as a barren pursuit: it was in vain that an habitual disorder, brought on by his application, interrupted his efforts; it was in vain that mankind treated him with ridicule while living, as they suffered his works to remain long unprinted and neglected when dead: still the Dutch philosopher went on, peeping into unwholesome ditches, wading through fens, dissecting spiders, and enumerating the blood-vessels of a snail: like the bee, whose heart he could not only distinguish, but dissect, he seemed instinctively impelled by his ruling passion, although he found nothing but ingratitude from man, and though his industry was apparently becoming fatal to himself. From him I will take some of the leading features in the history of those animals which breed in shells; previously taking my division from Aristotle, who, as was said above, divides them into three classes: the Turbinate, or those of the Snail-kind; the Bivalved, or those of the Oyster-kind; and the Multivalved, or those of the Acorn-shell kind. Of each I will treat in distinct chapters.

SUPPLEMENTARY NOTE.

On a subject so unlimited as that of Conchology, it would be hopeless to attempt to enter, in this place, into any thing like scientific details. We shall, therefore, confine ourselves to a popular view of shell-fish or molluscous animals, particularly to the various benefits which mankind and the animal world in general derive from them. In doing so, we shall take advantage of a series of interesting papers on the subject, which have appeared in the Magazine of Natural History.

One, and indeed the chief, circumstance which binds animals so closely is, the dependence each has upon another for a supply of necessary food. On contemplating this part of creation we behold a scene of havoc and devastation perpetually and everywhere going on, so that "there is not," as Smellie has remarked, "perhaps a single species of animated beings, whose existence depends not, more or less, upon the death and destruction of others." That this order of things, however cruel it may appear to us, is subservient to the good of the whole, cannot

admit of any doubt; and it is certain that molluscous animals in this relation play a not unimportant part. But, as it would be tedious to enumerate all or the greater portion of the animals to which they furnish nutriment, we shall confine ourselves to those which possess some peculiar interest, or which minister directly to the luxuries or necessities of man.

To commence with quadrupeds. Not only do the different species of walrus, inhabitants of ocean, feed partly on shell-fish, but perhaps you would not expect to find among their enemies animals strictly terrestrial; but the ouran-outang and the preacher-monkey often descend to the sea to devour what shell-fish they may find strewed upon the shores. The ouran-outang, according to Carreri Gemelli, feed in particular on a large species of oyster, and fearful of inserting their paws between the open valves, lest the oyster should close and crush them, they first place a tolerably large stone within the shell, and then drag out their victim with safety. The preacher-monkey is no less ingenious. Dampier saw several of them take up oysters from the beach, lay them on a stone, and beat them with another till they demolished the shells. Wafer observed the monkeys in the island of Gorgonia to proceed in a similar manner; and those of the Cape of Good Hope, if we are to credit La Loubere, perpetually amuse themselves by transporting shells from the shore to the tops of the mountains, with the intention undoubtedly of devouring them at leisure. Even the fox, when pressed by hunger, will deign to eat mussels and other bivalves; and the raccoon, whose fur is esteemed by hat-makers next in value to that of the beaver, when near the shore lives much on them, more particularly on oysters. We are told that it will watch the opening of the shells, dexterously put in its paw, and tear out the contents. Not however, without danger, for sometimes, we are assured, by a sudden closure, the oyster will catch the thief, and detain him until he is drowned by the return of the tide. In affirmation of this the following anecdotes may be recorded. A tradesman of Plymouth having placed some oysters in a cupboard, was surprised at finding, in the morning, a mouse caught by the tail, by the sudden collapsing of the shell. About forty years since at Ashburton, at the house of Mrs. Allridge, known by the name of the New Inn, a dish of Wembury oysters was laid in a cellar. A large oyster soon expanded its shell, and at the instant two mice pounced upon the "living luxury," and were at once crushed between the valves. The oyster, with the two mice dangling from its shell, was for a long time exhibited as a curiosity. Carew, in his 'History of Cornwall,' tells of an oyster that closed on three mice. An apposite instance is also epigrammatically recorded in the Greek Anthology.

These are amusing facts; the following, to the epicure at least, may be equally interesting. In some parts of England it is a prevalent and probably a correct opinion, that the shelled-snails contribute much to the fattening of their sheep. On the hill above Whitsand-bay in Cornwall, and in the south of Devonshire, the *Bulimus acutus* and the *Helix virgata*, which are found there in vast profusion, are considered to have this good effect; and it is indeed impossible that the sheep can browse on the short grass of the places just mentioned, without devouring a prodigious quantity, especially in the night, or after rain, when the *Bulimi* and *Helices* ascend the stunted blades. "The sweetest mutton," says Borlase, "is reckoned to be that of the smallest sheep, which feed on the commons where the sands are scarce covered with the green sod, and the grass exceedingly short; such are the towns or sand-hillocks in Piran-sand, Gwythien, Philac, and Senangreen, near the Land's End, and elsewhere in like situations. From these sands come forth snails of the turbinated kind, but

of different species, and all sizes from the adult to the smallest just from the egg; these spread themselves over the plains early in the morning, and, whilst they are in quest of their own food among the dews, yield a most fattening nourishment to the sheep."

Among birds the mollusca have many enemies. Several of the duck and gull tribes, derive at least a portion of their subsistence from them. The pied oyster-catcher receives its name from the circumstance of feeding on oysters and limpets, and its bill is so well adapted to its forcing asunder the valves of the one, and of raising the other from the rock, that "the Author of Nature," as Derham says, "seems to have framed it purely for that use." Several kinds of crows likewise prey upon shell-fish, and the manner in which they force the stronghold of their victims is very remarkable. A friend of Dr. Darwin's saw above a hundred crows, on the northern coast of Ireland, at once, preying upon mussels. Each crow took a mussel up in the air, twenty or forty yards high, and let it fall on the stones, and thus broke the shell. Many authorities might be adduced in corroboration of this statement. In Southern Africa so many of the Testacea are consumed by these and other birds, as to have given rise to an opinion that the marine shells found buried in the distant plains, or in the sides of the mountains, have been carried there by their agency, and not, as is generally supposed, by eruptions of the sea. Mr. Barrow, who is of this opinion, tells us, in confirmation of it, that "there is scarcely a sheltered cavern in the sides of the mountains that rise immediately from the sea, where living shell-fish may not be found any day of the year. Crows even, and vultures, as well as aquatic birds, detach the shell-fish from the rocks, and mount with them into the air: shells thus carried are said to be frequently found on the very summit even of the Table-mountain. In one cavern at the point of Mussel-bay," he adds, "I disturbed some thousands of birds, and found as many thousands of living shell-fish scattered on the surface of a heap of shells, that for aught I know, would have filled as many thousand waggons." The story therefore, of the ancient philosopher whose bald pate one of these unlucky birds mistook for a stone, and dropped a shell upon it, thereby killing at once both, is not so tramontane as to stumble all belief.

Land-shells furnish a few birds with part of their sustenance, and the principal of these are two well-known songsters, the blackbird and the thrush. When we call to recollection the vast and incalculable numbers of molluscous animals which crawl on the bottom, or swim in the bosom of the ocean, and the voracious habits of the swarms of fish which everywhere traverse it, we may reasonably conclude that their utility in this respect in the economy of nature is very great, and beyond human ken. And not only do the shell-fish nourish, but it has been presumed, or perhaps proved, that they impart a peculiar flavour to at least some of their devourers.

We may now advert to the more direct utility of the mollusca in furnishing to the fisherman the means of enticing to his snare the hapless victims of his art. On every coast the shell-fish peculiar to it are extensively employed for this purpose, but we may confine ourselves to those used by our own fishermen. At Salcomb on the coast of South Devon, the *Pholas dactylus* is found in great abundance, and is used with success. Many boat-loads of a river-mussel (*Unio Margaritifera*) are taken from the mouth of the Ythen, a river not far from Aberdeen, and employed in the fisheries of cod and ling established near Peterhead. The clam (*Pecten opercularis*) and the great mussel (*Modiola vulgaris*) are resorted to in other parts of the kingdom, and are eagerly sought after as a bait for cod; and that many thousands of limpets

(*Patella vulgaris*) and of the common mussel (*Mytilus edulis*) are daily torn from the rocks, to ensnare the common fishes of our coasts, and thus contribute materially to add one more luxury to the tables of the rich, and to give to the poor a cheap and wholesome diet. The large whelk (*Buccinum undatum*) and a species of rock-shell (*Murex despectus*) may likewise be enumerated among our ordinary baits; but the most valuable of the class is certainly *Loligo vulgaris*, or, as it is called by our fishermen, the sleeve or hoe-fish. With this animal one half of all the cod taken at Newfoundland is caught. It appears there in throngs about the beginning of August, and seems to succeed the capelan (the fish with which the other half is taken), as if to supply, immediately, provision to the cod, the traffic in which "brings wealth to individuals and strength to the state." It begins to retire from the coast in September. During violent gales of wind, hundreds of tons of them are often thrown up together in beds on the flat beaches, the decay of which spreads an intolerable effluvium around. It is made no use of except for bait; and, as it maintains itself in deeper water than the capelan, instead of nets being used to take it, it is *jigged*,—a jigger being a number of hooks radiating from a fixed centre, made for the purpose. The cod is in best condition after having fed on it.

Crowds of the inferior animals certainly feed on the mollusca, but as there is little interest in the detail, a very few examples will here suffice. Two small leeches (*Hirudo bioculata* and *complanata*) often wage successful war against the fresh-water snails so abundant in our ditches; and another species (*H. hyalina*), not so cruel in disposition, draws its nourishment from the sanies which flows from the *Planorbis carinatus*. Its calcareous envelope is no protection to the mussel against the wiles of the *Nymphon grossipes*; thousands of littoral shells are devoured by the sea-anemones (*Actinia*); and the common star-fish knows so well how to force the oyster from his close retreat, and destroys such numbers of them, that every dredger who observes one of their enemies, and does not tread on and kill it, or throw it upon the shore, is liable to some penalty.

To some animals among the inferior tribes, shells afford a house and a place of refuge, as necessary to them as either air or food. The turbinated univalves become, after the death of their proper owners, the habitations of the soldier or hermit crabs, whose naked and slender abdomens, covered merely with a skin of a delicate texture, would without this foreign covering, be crushed to pieces in the strife of waves and rocks to which they are exposed, or devoured by the enemies which surround them. A singular species of soft worm, or *Siphunculus*, discovered by Mr. Montagu, inhabits old and worn specimens of the *Strombus pes Pelecani*, whose aperture it closes up with agglutinated sand, leaving only a small round hole, within which it lives in security; and another species not yet described, though common on the coasts of Scotland, takes possession of the common tooth-shell (*Dentalium entalis*), and secures the aperture in the same manner. The beautiful and delicate paper-nautilus, is not navigated over the surface of the ocean by its own architect, but by a species of Ocythoe, or Cuttle-fish, its parasitic inhabitant. This surprising fact was long disputed among naturalists; but the specimens brought to England by the gentlemen of the unfortunate Congo expedition, have enabled Dr. Leach and others to give it very great probability, if not to demonstrate its truth. Mr. Craunch tells us, that, having placed two living specimens in a vessel of sea-water, the animals very soon protruded their arms, and swam on and below the surface, having all the actions of the common cuttle of our seas. By means of their suckers they adhered firmly to any substance with

which they came in contact, and when sticking to the sides of the basin the shell might easily be withdrawn from the animals. They had the power of retiring completely within the shell, and of leaving it entirely.

A vast number of molluscous animals are themselves carnivorous, and become thus a means, in the hand of Providence, of keeping in check the multiplication of the tribes on which they prey, and of preserving between them that due proportion and "balance of power" which is as necessary in the animal as in the political world. Others, again, are gifted with the remarkable property of boring through stone and wood, and thus reduce to dust the rock over which the waves might have broken in vain, and remove those forests which the torrents and tornadoes of tropical climes annually float to the sea. In this sense, even the "fell Tereido" ministers to good. "The seaman," says Mason Good, in his Book of Nature, "as he beholds the ruin before him, vents his spleen against the little tribes that have produced it, and denounces them as the most mischievous vermin in the ocean. But a tornado arises, the strength of the whirlwind is abroad, the clouds pour down a deluge over the mountains, and whole forests fall prostrate before its fury. Down rolls the gathering wreck towards the deep, and blocks up the mouth of that very creek the seaman has entered, and where he now finds himself in a state of captivity. How shall he extricate himself from his imprisonment?—an imprisonment as rigid as that of the Baltic in the winter season. But the hosts of the Tereido are in motion; thousands of little augers are applied to the floating barrier, and attack it in every direction. It is perforated, it is lightened, it becomes weak; it is dispersed, or precipitated to the bottom; and what man could not effect is the work of a worm. Thus it is that nothing is made in vain; and that, in physics, as well as in morals, although evil is intermingled with good, the good ever maintains a predominancy."

The conversion, through their agency, of other materials into lime, seems, however, to be the great purport of the creation of molluscous animals. Shells consist of carbonate of lime with a greater or less proportion of animal matter, and the animals form these shells from their food, which contains a very little lime, or perhaps none at all. "Chalk, marl, and limestone," says Buffon, "consist entirely of the dust or fragments of shells." This, at first, may seem an extravagant doctrine, and Imagination herself startles when she attempts to sum up the millions and tens of millions which must have gone to the formation of such deep and extensive strata. It is, nevertheless, in a great measure true. Hence the study of shells, so long ridiculed by the wits of the age, as an abuse of time and waste of money, becomes necessary to all those who make the structure of the earth, and the various changes which it has undergone, an object of attention. For shells are found in abundance in a great variety of rocks and positions: they constitute the medals of the ancient world; and, from an accurate acquaintance with their different species, and with the nature of the animals that inhabited them, many curious and important deductions respecting the formation and changes of the crust of the earth may be drawn. It is from their composition that even recent shells become useful as a manure, a purpose to which they are occasionally applied in this and other countries; and it has been ascertained by comparative experiments, that, on turf lands in particular, they act more beneficially than quicklime. And in China, India, Ceylon, and Africa, where there is no stone fitted for burning into lime, and where shells are abundant, these are resorted to, and the lime procured from them is said to be peculiarly white and

pure: so much so, that the people, and even the ladies in India, to increase the pungency, mix it with their betel leaf and areka nut, which they chew as our sailors do tobacco.

Of the more direct modes by which molluscous animals contribute to the wants and luxuries of man, we shall have occasion to speak when we reach that part of the text which treats of oysters, pearl fisheries, &c.

CHAP. V.

OF TURBINATED SHELL-FISH OF THE SNAIL KIND.

To conceive the manner in which those animals subsist that are hid from us at the bottom of the deep, we must again have recourse to one of a similar nature and formation that we know. The history of the garden-snail has been more copiously considered than that of the elephant; and its anatomy is as well, if not better, known: however, not to give any one object more room in the general picture of nature than it is entitled to, it will be sufficient to observe that the snail is surprisingly fitted for the life it is formed to lead. It is furnished with the organs of life in a manner almost as complete as the largest animal: with a tongue, brain, salival ducts, glands, nerves, stomach, and intestines: liver, heart, and blood-vessels: besides this, it has a purple bag that furnishes a red matter to different parts of the body, together with strong muscles that hold it to the shell, and which are hardened, like tendons, at their insertion.

But these it possesses in common with other animals. We must now see what it has peculiar to itself. The first striking peculiarity is, that the animal has got its eyes on the points of its largest horns. When the snail is in motion, four horns are distinctly seen: but the two uppermost, and longest, deserve peculiar consideration, both on account of the various motions with which they are endued, as well as their having their eyes fixed at the extreme ends of them. These appear like two blackish points at their ends. When considered as taken out of the body, they are of a bulbous or turnip-like figure; they have but one coat; and the three humours which are common in the eyes of other animals, namely, the vitreous, the aqueous, and the crystalline, are, in these, very indistinctly seen. The eyes the animal can direct to different objects at pleasure, by a regular motion out of the body; and sometimes it hides them by a very swift contraction into the belly. Under the small horns is the animal's mouth; and though it may appear too soft a substance to be furnished with teeth, yet it has not less than eight of them, with which it devours leaves, and other substances, seemingly harder than itself; and with which it sometimes bites off pieces of its own shell.

But what is most surprising in the formation of this animal are the parts that serve for generation. Every snail is at once male and female; and while it impregnates another, is itself impregnated in turn. The vessels, supplying the fluid for this purpose, are placed chiefly in the forepart of the neck, and extend themselves over the body; but the male and female organs of generation are always found united, and growing together. There is a large opening on the right side of the neck, which serves for very different purposes. As a vent, it gives a passage to the excrements; as a mouth, it serves for an opening for respiration; and also as an organ of generation, it dilates when the desire of propagation begins. Within this each animal has those parts, or something similar thereto, which continue the kind.

For some days before coition, the snails gather together, and lie quite near to each other, eating very little in the meantime; but they settle their bodies in such a posture, that the neck and head are placed upright. In the meantime, the apertures on the side of the neck being greatly dilated, two organs, resembling intestines, are seen issuing from them, which some have thought to be the instruments of generation. Beside the protrusion of these, each animal is possessed of another peculiarity; for, from the same aperture, they launch forth a kind of dart at each other, which is pretty hard, barbed, and ending in a very sharp point. This is performed when the apertures approach each other; and then the one is seen to shoot its weapon, which is received by the other, though it sometimes fails to the ground; some minutes after, the snail which received the weapon, darts one of its own at its antagonist, which is received in like manner. They then softly approach still nearer, and apply their bodies one to the other, as closely as the palms and fingers of hands when grasped together. At that time the horns are seen variously moving in all directions; and this sometimes for three days together. The coupling of these animals is generally thrice repeated, at intervals of fifteen days each; and, at every time, a new dart is mutually emitted.

At the expiration of eighteen days, the snails produce their eggs, at the opening of the neck, and hide them in the earth with the greatest solicitude and industry. These eggs are in great numbers, round, white, and covered with a soft shell: they are also stuck to each other by an imperceptible slime, like a bunch of grapes, of about the size of a small pea.

When the animal leaves the egg, it is seen with a very small shell on its back, which has but one convolution; but in proportion as it grows, the shell increases in the number of its circles. The shell always receives its additions at the mouth, the first centre still remaining; the animal sending forth from its body that slime which hardens into a stony substance, and

still is fashioned into similar volutions. The garden-snail seldom exceeds four rounds and a half; but some of the sea-snails arrive even at ten.

The snail, thus fitted with its box, which is light and firm, finds itself defended, in a very ample manner, from all external injury. Whenever it is invaded, it is but retiring into this fortress, and waiting patiently till the danger is over. Nor is it possessed only of a power of retreating into its shell, but of mending it when broken. Sometimes these animals are crushed seemingly to pieces, and, to all appearance, utterly destroyed; yet still they set themselves to work, and, in a few days, mend all their numerous breaches. The same substance by which the shell is originally made goes to the re-establishment of the ruined habitation. But all the junctures are very easily seen, for they have a fresher colour than the rest; and the whole shell, in some measure, resembles an old coat patched with new pieces. They are sometimes seen with eight or ten of these patches; so that the damage must have been apparently irreparable. Still, however, though the animal is possessed of the power of mending its shell, it cannot, when come to its full growth, make a new one. Swammerdam tried the experiment; he stripped a snail of its shell, without hurting any of the blood-vessels, retaining that part of the shell where the muscles were inserted; but it died in three days after it was stripped of its covering: not, however, without making efforts to build up a new shell; for, before its death it pressed out a certain membrane round the whole surface of its body. This membrane was entirely of the shelly nature, and was intended, by the animal, as a supply towards a new one.

As the snail is furnished with all the organs of life and sensation, it is not wonderful to see it very voracious. It chiefly subsists upon leaves and plants of trees; but is very delicate in its choice. When the animal moves to seek its food, it goes forward by means of that broad muscular skin which sometimes is seen projecting round the mouth of the shell; this is expanded before, and then contracted with a kind of undulating motion, like a man attempting to move himself forward by one arm while lying on his belly. But the snail has another advantage, by which it not only smooths and planes its way, but also can ascend in the most perpendicular direction. This is by that slimy substance with which it is so copiously furnished, and which it emits wherever it moves. Upon this slime, as upon a kind of carpet, it proceeds slowly along, without any danger of wounding its tender body against the asperities of the pavement; by means of this it moves upwards to its food upon the trees, and by this descends without danger of falling, and breaking its shell by the shock.

The appetite of these animals is very great; and the damage gardeners in particular sustain from them, makes them employ every method

for their destruction. Salt will destroy them, as well as soot; but a tortoise in a garden is said to banish them much more effectually.

At the approach of winter, the snail buries itself in the earth; or retires to some hole, to continue in a torpid state during the severity of the season. It is sometimes seen alone, but more frequently in company in its retreat; several being usually found together, apparently deprived of life and sensation. For the purposes of continuing in greater warmth and security, the snail forms a cover or lid to the mouth of its shell with its slime, which stops it up entirely, and thus protects it from every external danger. The matter of which the cover is composed, is whitish, somewhat like plaster, pretty hard and solid, yet, at the same time, porous and thin, to admit air, which the animal cannot live without. When the cover is formed too thick, the snail then breaks a little hole in it, which corrects the defect of that closeness which proceeded from too much caution. In this manner, sheltered in its hole from the weather, defended in its shell by a cover, it sleeps during the winter; and, for six or seven months, continues without food or motion, until the genial call of spring breaks its slumber, and excites its activity.

The snail, having slept for so long a season, wakes one of the first fine days of April, breaks open its cell, and sallies forth to seek for nourishment. It is not surprising that so long a fast should have thinned it, and rendered it very voracious. At first, therefore, it is not very difficult in the choice of its food; almost any vegetable that is green seems welcome; but the succulent plants of the garden are chiefly grateful; and the various kinds of pulse are, at some seasons, almost wholly destroyed by their numbers. So great is the multiplication of snails in some years, that gardeners imagine they burst from the earth. A wet season is generally favourable to their production; for this animal cannot bear very dry seasons, or dry places, as they cause too great a consumption of its slime, without plenty of which it cannot subsist in health and vigour.¹

¹ One species of land-snail is used in some countries as food. The Romans took great pains in rearing these snails. They kept them in sties called *cochlearia*, which were generally constructed under rocks or eminences moistened by a passing stream. If, however, the sty was not sufficiently humid, a water-pipe, bored full of holes, like a watering-pot, was introduced, by which means it was continually sprinkled and kept in a favourable state. Here the snails required little attendance or food, supplying themselves as they crawled about the sides or floor of their prison; but when it was wished to fatten them, they were fed with bran and sodden wine; and, on this generous fare, they grew occasionally to such a size that, according to Varro, the shell would hold full ten quarts! We need no longer hold up to imitation the temperance of the younger Pliny, whose supper consisted of *only three* snails, two eggs, a barley cake, a lettuce, sweet wine, and snow; but, alas! participating in that degeneracy which is said

Such are the most striking particulars in the history of this animal; and this may serve as a general picture, to which the manners and habitudes of the other tribes of this class may be compared and referred. These are, the sea-snail, of which naturalists have, from the apparent difference of their shells, mentioned fifteen kinds;² the fresh-water-snail, of which there are eight kinds; and the land-snail, of which there are five. These all bear a strong resemblance to the garden-snail, in the formation of their shell, in their hermaphrodite natures, in the slimy substance with which they are covered, in the formation of their intestines, and the disposition of the hole on the right side of the neck, which serves at once for the discharge of the fæces, for the lodging the instruments of generation, and for respiration, when the animal is under a necessity of taking in a new supply.

But, in nature, no two kinds of animals, however like each other in figure or conformation, are of manners entirely the same. Though the common garden-snail bears a very strong resemblance to that of fresh-water, and that of the sea, yet there are differences to be found, and those very considerable ones.

If we compare them with the fresh-water-snail, though we shall find a general resemblance, yet there are one or two remarkable distinctions: and, first, the fresh-water-snail, and, as I should suppose, all snails that live in water, are peculiarly furnished with a contrivance by Nature, for rising to the surface, or sinking to the bottom. The manner in which this is performed, is by opening and shutting the orifice on the right side of the neck, which is furnished with muscles for that purpose. The snail sometimes gathers

to characterize the human race of the present day, our snails never attain the twentieth part of the bulk of Varro's. They are still eaten in great numbers on the continent of Europe, particularly during Lent. In Switzerland, where there are gardens in which they are fed in many thousands together, a considerable trade is carried on in them about that season; and at Vienna, a few years ago, seven of them were charged at an inn the same as a plate of veal or beef. The usual modes of preparing them for the table are, either boiling, frying them in butter, or sometimes stuffing them with farce-meat; but in what manner soever they are dressed, it is said, their sliminess always in a great measure remains. Those edible snails were introduced into England, about the middle of the sixteenth century, by Charles Howard, of the Arundel family, and afterwards by the eccentric Sir Kenelm Digby, either as being a favourite foreign delicacy, or in order to cure his beautiful wife of a consumptive disease. The fashion seems to have taken, for the great master-cook, Robert May, has left several receipts for dressing snails among the secrets of his fifty years' experience; but, like other fashions, it soon passed away, for the English have no relish of such "liquorish viands." Some years ago they were introduced in Scotland by Pat. Neill, Esq., and placed in his curious and most interesting garden at Cannonmills; but, we believe they have not prospered, and are gradually disappearing.—Ed.

² D'Argenville's Conchyliologie.

this aperture into an oblong tube, and stretches or protends it above the surface of the water, in order to draw in or expel the air, as it finds occasion. This may not only be seen, but heard also by the noise which the snail makes in moving the water. By dilating this it rises; by compressing it the animal sinks to the bottom. This is effected somewhat in the manner in which little images of glass are made to rise or sink in the water, by pressing the air contained at the mouth of the tubes, so that it shall drive the water into their hollow bodies, which, before, were filled only with air, and thus make them heavier than the element in which they swim. In this manner does the fresh-water-snail dive or swim, by properly managing the air contained in its body.

But what renders these animals far more worthy of notice is, that they are viviparous, and bring forth their young not only alive, but with their shells upon their backs. This seems surprising; yet it is incontestably true: the young come to some degree of perfection in the womb of the parent; there they receive their stony coat; and from thence are excluded, with a complete apparatus for subsistence.

"On the twelfth of March," says Swammerdam, "I began my observations upon this snail, and collected a great number of the kind, which I put into a large basin filled with rain-water, and fed, for a long time, with potter's earth dissolved in the water about them. On the thirteenth of the same month I opened one of these snails, when I found nine living snails in its womb: the largest of these were placed foremost, as the first candidates for exclusion. I put them into fresh-water, and they lived till the eighteenth of the same month, moving and swimming, like snails full grown: nay, their manner of swimming was much more beautiful." Thus, at whatever time of the year these snails are opened they are found pregnant with eggs, or with living snails; or with both together.

This striking difference between the fresh-water and the garden snail, obtains also in some of the sea kind: among which there are some that are found viviparous, while others lay eggs in the usual manner. Of this kind are one or two of the Buccinums; within which living young have been frequently found upon their dissection. In general, however, the rest of this numerous class bring forth eggs; from whence the animal bursts at a proper state of maturity, completely equipped with a house, which the moistness of the element where it resides does not prevent the inhabitant from enlarging. How the soft slime of the snail hardens, at the bottom of the sea, into the stony substance of a shell, is not easy to conceive. This slime must at least be possessed of very powerful petrifying powers.

All animals of the snail kind, as was observed before, are hermaphrodites; each containing the instruments of generation double. But some of

the sea kinds copulate in a different manner from those of the garden. The one impregnates the other; but, from the position of the parts, is incapable of being impregnated by the same in turn. For this reason it is necessary for a third to be admitted as a partner in this operation: so that, while one impregnates that before it, another does the same office by this; which is itself impregnated by a fourth. In this manner, Mr. Adanson has seen vast numbers of sea-snails united together in a chain impregnating each other. The Bulin and the Coret perform the offices of male and female at the same time. The orifices in these are two, both separate from each other: the opening by which the animal performs the office of the male being at the origin of the horns; that by which it is passive, as the female, being farther down upon the neck. It may also be observed, as a general rule, that all animals that have this orifice, or verge, as some call it, on the right side, have their shells turned from the right to the left; on the contrary, those which have it on the left side, have their shells turning from left to right, in a contrary direction to the former.

But this is not the only difference between land and sea snails. Many of the latter entirely want horns; and none of them have above two. Indeed, if the horns of snails be furnished with eyes, and if, as some are willing to think, the length of the horn, like the tube of a telescope, assists vision, these animals that chiefly reside in the gloomy bottom of the deep, can have no great occasion for them. Eyes would be unnecessary to creatures whose food is usually concealed in the darkest places; and who, possessed of very little motion, are obliged to grope for what they subsist on. To such, I say, eyes would rather be an obstruction than an advantage; and, perhaps, even those that live upon land are without them.

Those that have seen the shells of sea-snails, need not be told that the animal which produces them is larger than those of the same denomination upon land. The sea seems to have the property of enlarging the magnitude of all its inhabitants; and the same proportion that a trout bears to a shark, is often seen to obtain between a shell bred upon the land, and one bred in the ocean. Its convolutions are more numerous. The garden-snail has but five turns at the most; in the sea-snail the convolutions are sometimes seen amounting to ten.

There is a difference also in the position of the mouth in the garden and the water snail. In the former, the mouth is placed crosswise, as in quadrupeds; furnished with jaw-bones, lips, and teeth. In most of the sea-snails, the mouth is placed longitudinally in the head; and in some obliquely, or on one side. Others, of the Trochus kind, have no mouth whatsoever; but are furnished with a trunk, very long in some kinds, and shorter in others.

Snails of the Trochus kind, furnished thus with an instrument of offence, deserve our particular attention. The trunk of the Trochus is fleshy, muscular, supple, and hollow. Its extremity is bordered with a cartilage, and toothed like a saw. The snails that are provided with this may be considered as the predacious tribe among their fellows of the bottom. They are among snails what the tiger, the eagle, or the shark, is among beasts, birds, or fishes. The whole race of shelled animals avoid their approach; for their habitations, however powerfully and strongly built, though never so well fortified, yield to the superior force of these invaders. Though provided with a thick clumsy shell themselves, yet they move with greater swiftness at the bottom than most other shell-fish, and seize their prey with greater facility. No shell so large but they will boldly venture to attack; and, with their piercing auger-like trunk, will quickly bore it through. No efforts the other animal makes can avail: it expands itself, and rises to the surface; but the enemy rises with it: it again sinks to the bottom, but still its destroyer closely adheres. In this manner the carnivorous shell-fish, as some naturalists call it, sticks for several days, nay, weeks, to its prey, until, with its trunk, it has sucked out all the substance, or until it drops off, when the other begins to putrefy.

Thus it would seem, throughout nature, that no animal is so well defended but that others are found capable of breaking in upon its intrenchments. The garden-snail seems tolerably well guarded; but the wall of its shell is paper itself, in comparison with that which fortifies some of the sea-snail kind. Beside this thick shell, many of them are also furnished with a lid, which covers the mouth of the shell, and which opens and shuts at the animal's pleasure. When the creature hunts for food, it opens its box, gropes or swims about; and, when satisfied, drops its lid, and sinks to the bottom: there it might be supposed to remain in perfect security; but the trochus soon finds the way to break into the thickest part of its enclosure, and quickly destroys it with the most fatal industry.

The being liable to the attacks of the trochus seems to be a calamity to which most of this tribe are subject. Scarce a shell is met with entire and sound to the end of its convolutions; but particularly the thinnest shells are the most subject to be thus invaded. As their shells are easily pierced, the predatory shell-fish, or the sea-worm, chiefly seek them for subsistence; and of those thin paper-like shells, not one in a hundred is found that has not suffered some disaster. As they are lighter than other shell-fish, they swim with greater ease; and this is the chief method of avoiding their heavier thick-shelled pursuers. The food of all snails properly lies at the bottom; when, therefore, the nautilus, or other thin-shelled fish, are seen busily swimming at the surface, it may be that, instead of sporting

or sunning themselves, as some are apt to suppose, they are actually labouring to escape their most deadly pursuers.

Of all sea-snails, that which is most frequently seen swimming upon the surface, and whose shell is the thinnest, and most easily pierced, is the nautilus. Whether, upon these occasions, it is employed in escaping its numerous enemies at the bottom, or seeking for food at the surface, I will not venture to decide. It seems most probable, that the former is the cause of its frequently appearing; for, upon opening the stomach, it is found to contain chiefly that food which it finds at the bottom. This animal's industry, therefore, may be owing to its fears: and all those arts of sailing which it has taught mankind, may have been originally the product of necessity. But the nautilus is too famous not to demand a more ample description. Although there be several species of the nautilus, yet they all may be divided into two: the one with a white shell, as thin as paper, which it often is seen to quit, and again to resume; the other with a thicker shell, sometimes of a beautiful mother-of-pearl colour, and that quits its shell but rarely. This shell, outwardly, resembles that of a large snail, but is generally six or eight inches across; within it is divided into forty partitions, that communicate with each other by doors, if I may so call them, through which one could not thrust a goose-quill: almost the whole internal part of the shell is filled by the animal; the body of which, like its habitation, is divided into as many parts as there are chambers in its shell: all the parts of its body communicate with each other, through the doors or openings, by a long blood-vessel, which runs from the head to the tail: thus the body of the animal, if taken out of the shell, may be likened to a number of soft bits of flesh, of which there are forty, threaded upon a string. From this extraordinary conformation, one would not be apt to suppose that the nautilus sometimes quitted its shell, and returned to it again; yet nothing, though seemingly more impossible, is more certain. The manner by which it contrives to disengage every part of its body from so intricate a habitation, by which it makes a substance, to appearance as thick as one's wrist, pass through forty doors, each of which would scarcely admit a goose-quill, is not yet discovered: but the fact is certain; for the animal is often found without its shell; and the shell more frequently destitute of the animal. It is most probable, that it has a power of making the substance of one section of its body remove up into that which is next; and thus, by multiplied removals, it gets free.³

³ Our author has confounded two shells very different in their characters. The one is an Argonauta, and the other a Nautilus. The paper argonaut is extremely thin, spiral, involute, membranous, and unilocular, or consisting of a single apartment or cell. It has a narrow keel, bordered on each side by a row

But this, though very strange, is not the peculiarity for which the nautilus has been the most distinguished. Its "spreading the thin oar," and "catching the flying gale," to use the poet's description of it, has chiefly excited human curiosity. These animals, particularly those of the white light kind, are chiefly found in the Mediterranean; and scarcely any who have sailed on that sea, but must often have seen them. When the sea is calm, they are observed floating on the surface; some spreading their little sail; some rowing with their feet, as if for life and death; and others still, floating upon their mouths, like a ship with the keel upward. If taken while thus employed, and examined, the extraordinary mechanism of their limbs for sailing will appear more manifest. The nautilus is furnished with eight feet, which issue near the mouth, and may as properly be called barbs: these are connected to each other by a thin skin, like that between the toes of a duck, but much thinner and more transparent. Of these eight feet thus connected, six are short, and these are held up as sails to catch the wind in sailing; the two others are longer, and are kept in the water, serving like paddles to steer their course by. When the weather is quite calm, and the animal is pursued from below, it is then seen expanding only a part of its sail, and rowing with the rest: whenever it is interrupted, or fears danger from above, it instantly furls the sail, catches in all its oars, turns its shell mouth downward, and

of conical sharp tubercles; its sides are nearly flat, with numerous angular waved ridges; its colour is white, with the keel often brown. The shell is very thin and brittle; from which circumstance it has obtained the name of paper nautilus. This shell is the nautilus of the ancients, mentioned in the writings of Pliny and others. It is supposed, that, in the early ages of society, the art of navigation owed its origin to the expert management of this instinctive sailor. It has eight arms, two of which are furnished at the extremities with an oval membrane, which it can at pleasure raise and expand to the gale, while the other six hang over the sides of the shell, and are used in the manner of oars. Impelled by the breeze, this little animal, in its tender bark, has the appearance of a vessel under sail, and glides along the smooth surface of the ocean. On the approach of danger he withdraws to his shell, and, by a speedy absorption of the water, he is rendered heavier than the surrounding element, and suddenly sinks to the fathomless depths of the ocean. The animal is said to be very quick-sighted; and, on this account, is seldom taken when sailing. The *Keel'd Argonaut* is very thin; shaped like a cone; flattened at the sides: the top of the spire turns to one side. This is a very rare shell, and inhabits Amboyna. The *Great Chambered Nautilus* is a native of the Indian seas, and frequently arrives at a very considerable size. The curious structure of this shell (and which also runs, with some variation, through the whole genus) cannot be contemplated without admiration; each cell or camera communicating with the next by a small and short open tube, the first or principal cell being far larger than the rest, and appearing destined to contain the chief part or body of the inhabiting animal, the nature of which is not yet properly understood.—ED.

instantly sinks to the bottom. Sometimes also it is seen pumping the water from its leaking hulk; and, when unfit for sailing, deserts its shell entirely. The forsaken hulk is seen floating along, till it dashes, by a kind of shipwreck, upon the rocks or the shore.

From the above description, I think we may consider this animal rather as attempting to save itself from the attacks of its destroyers, than as rowing in pursuit of food. Certain it is, that no creature of the deep has more numerous and more powerful enemies.⁴ Its shell is scarcely ever found in perfect preservation; but is generally seen to bear some marks of hostile invasion. Its little arts, therefore, upon the surface of the water, may have been given it for protection; and it may be thus endued with comparative swiftness, to avoid the crab, the sea-scorpion, the trochus, and all the slower predacious reptiles that lurk for it at the bottom of the water.

From this general view of snails, they appear to be a much more active animated tribe, than from their figure one would at first conceive. They seem to an inattentive spectator, as mere inert masses of soft flesh, rather loaded than covered with a shell, scarcely capable of motion, and insensible to all the objects around them. When viewed more closely, they are found to be furnished with the organs of life and sensation in tolerable perfection: they are defended with armour that is at once both light and strong; they are as active as their necessities require; and are possessed of appetites more poignant than those of animals that seem much more perfectly formed. In short, they are a fruitful industrious tribe; furnished, like all other animals, with the powers of escape and invasion: they have their pursuits and their enmities; and, of all creatures of the deep, they have most to fear from each other.

CHAP. VI.

OF BIVALVED SHELL-FISH, OR SHELLS OF THE OYSTER KIND.

It may seem whimsical to make a distinction between the animal perfections of turbinated and bivalved shell-fish; or to grant a degree of superiority to the snail above the oyster. Yet this distinction strongly and apparently obtains in nature; and we shall find the bivalved tribe of animals in every respect inferior to those we have been describing. Inferior in all their sensations; inferior in their powers of motion; but particularly inferior in their system of animal

generation. The snail tribe, as we saw, are hermaphrodite, but require the assistance of each other for fecundation; all the bivalve tribe are hermaphrodite in like manner, but they require no assistance from each other towards impregnation; and a single mussel or oyster, if there were no other in the world, would quickly replenish the ocean. As the land-snail, from its being best known, took the lead in the former class, so the fresh-water-mussel, for the same reason may take the lead in this. The life and manners of such as belong to the sea will be best displayed in the comparison.

The mussel, as is well known, whether belonging to fresh or salt water, consists of two equal shells, joined at the back by a strong muscular ligament, that answers all the purposes of a hinge. By the elastic contraction of these, the animal can open its shell at pleasure, about a quarter of an inch from each other. The fish is fixed to either shell by four tendons, by means of which it shuts them close, and keeps its body firm from being crushed by any shock against the walls of its own habitation. It is furnished, like all other animals of this kind, with vital organs, though these are situated in a very extraordinary manner. It has a mouth furnished with two fleshy lips; its intestine begins at the bottom of the mouth, passes through the brain, and makes a number of circumvolutions through the liver; on leaving this organ, it goes on straight into the heart, which it penetrates, and ends in the anus; near which the lungs are placed, and through which it breathes, like those of the snail kind; and in this manner its languid circulation is carried on.¹

But the organs of generation are what most deserve to excite our curiosity. These consist in each mussel of two ovaries, which are the female part of its furniture, and of two seminal vessels, resembling what are found in the male. Each ovary and each seminal vessel has its own proper canal: by the ovary-canal the eggs descend to the anus; and there also the seminal canals send their fluids to impregnate them. By this contrivance, one single animal suffices for the double purposes of generation; and the eggs are excluded and impregnated by itself alone.

As the mussel is thus furnished with a kind of self-creating power, there are few places where it breeds that it is not found in great abundance. The ovaries usually empty themselves of their eggs in spring, and they are replenished in autumn. For this reason they are found empty in summer, and full in winter. They produce in great numbers, as all bivalved shell-fish are found to do. The fecundity of the snail kind is trifling in comparison to the fertility of these. Indeed it may be asserted as a general rule in nature, that the more helpless and contemptible the animal, the more prolific it is always found.

⁴ We do not ascribe our seldom finding the shells of the Paper Argonaut perfect, to their living in a state of warfare, but to the extreme delicacy of their shells, which will scarcely bear to be turned, even with the animal out of it.—ED.

¹ M. Mery, Anat. des Moules d'Etang.

Thus all creatures that are incapable of resisting their destroyers, have nothing but their quick multiplication for the continuation of their existence.

The multitude of these animals in some places is very great; but from their defenceless state, the number of their destroyers are in equal proportion. The crab, the cray-fish, and many other animals are seen to devour them; but the trochus is their most formidable enemy. When their shells are found deserted, if we then observe closely, it is most probable we shall find that the trochus has been at work in piercing them. There is scarcely one of them without a hole in it; and this probably was the avenue by which the enemy entered to destroy the inhabitant.

But notwithstanding the numbers of this creature's animated enemies, it seems still more fearful of the agitations of the element in which it resides; for if dashed against rocks, or thrown far on the beach, it is destroyed without a power of redress. In order to guard against these, which are to this animal the commonest and the most fatal accidents, although it has a power of slow motion, which I shall presently describe, yet it endeavours to become stationary, and to attach itself to any fixed object it happens to be near. For this purpose, it is furnished with a very singular capacity of binding itself by a number of threads to whatever object it approaches; and these Reaumur supposed it spun artificially, as spiders their webs which they fasten against a wall. Of this, however, later philosophers have found very great reason to doubt. It is therefore supposed that these threads, which are usually called the beard of the mussel, are the natural growth of the animal's body, and by no means produced at pleasure. Indeed the extreme length of this beard in some, which far exceeds the length of the body, seems impossible to be manufactured by the thrusting out and drawing in of the tongue, with the glutinous matter of which the French philosopher supposed those threads were formed. It is even found to increase with the growth of the animal; and as the mussel becomes larger and older, the beard becomes longer, and its filaments more strung.² Be this as it will, nothing is more certain than that the mussel is found attached by these threads to every fixed object; sometimes, indeed, for want of such an object, these animals are found united to each other; and though thrown into a lake separately, they are taken out in bunches of many together.

To have some fixed resting-place where the mussel can continue, and take its accidental food, seems the state that this animal chiefly desires. Its instrument of motion, by which it contrives to reach the object it wants to bind itself to, is that muscular substance resembling

a tongue, which is found long in proportion to the size of the mussel. In some it is two inches long, in others not a third part of these dimensions. This the animal has a power of thrusting out of its shell; and with this it is capable of making a slight furrow in the sand at the bottom. By means of this furrow it can erect itself upon the edge of its shell; and thus continuing to make the furrow in proportion as it goes forward, it reaches out its tongue, that answers the purpose of an arm, and thus carries its shell edgewise, as in a groove, until it reaches the point intended. There, where it determines to take up its residence, it fixes the ends of its beard, which are glutinous, to the rock or the object, whatever it be; and, thus, like a ship at anchor, braves all the agitations of the water. Sometimes the animal is attached by a large number of threads; sometimes but by three or four, that seem scarce able to retain it. When the mussel is fixed in this manner, it lives upon the little earthy particles that the water transports to its shells, and perhaps the flesh of the most diminutive animals. However, it does not fail to grow considerably; and some of this kind have been found a foot long. I have seen the beards a foot and a half; and of this substance the natives of Palermo sometimes make gloves and stockings.³

These shell-fish are found in lakes, rivers, and in the sea. Those of the lake often grow to a very large size; but they seem a solitary animal, and are found generally separated from each other. Those of rivers are not so large, but yet in greater abundance; but the sea-mussel of all others is perhaps the most plenty. These are often bred artificially in salt-water marshes that are overflowed by the tide; the fishermen throwing them in at the proper seasons; and there being undisturbed by the agitations of the sea, and not preyed upon by their powerful enemies at the bottom, they cast their eggs, which soon become perfect animals, and these are generally found in clusters of several dozen together. It

³ The shell from which gloves and stockings are woven at Palermo is the *Pinna* or wing-shell. It is very fragile, upright, gaping at one end, and furnished with a long byssus or beard. From this substance is woven the robes of state for their monarchs.—The *Prickly Pinna* inhabits the Mediterranean, the Cape, and the East Indies; it is sub-triangular, with numerous longitudinal ribs, with alternately broader ones, and covered with grooved spines. It is of a horn-colour, and pellucid; generally about five inches in length. A small species of crab often takes up its abode within the shell of the pinna, and is said to act as a monitor on the approach of danger. Some have attributed this to a kind of hospitality in the animal giving protection to this intruder, who, it is likely, is an unwelcome guest to the proper inhabitant.—The *Giant Pinna* grows often to the size of two feet and a half in length, and nine inches in breadth. The Great or *Ingens Pinna*, a native of the British seas, is not unfrequently found a foot in length. It is found of a larger size about the Hebrides, than any other part of Great Britain.—ED.

² Mercier du Paty, sur le Bouchots a Moules. Tom. ii. de l'Academie de la Rochelle.

requires a year for the peopling of a mussel bed; so that, if the number consists of forty thousand, a tenth part may annually be left for the peopling the bed anew. Mussels are taken from their beds from the month of July to October; and they are sold at a very moderate price.

From this animal the oyster differs very little, except in the thickness of its shell, and its greater imbecility. The oyster, like the mussel, is formed with organs of life and respiration, with intestines which are very voluminous, a liver, lungs, and heart. Like the mussel, it is self-impregnated; and the shell, which the animal soon acquires, serves it for its future habitation. Like the mussel, it opens its shell to receive the influx of water; and like that animal is strongly attached to its shells both above and below.

But it differs in many particulars. In the first place, its shells are not equal, the one being cupped, the other flat: upon the cupped shell it is always seen to rest; for if it lay upon the flat side it would then lose all its water. It differs also in the thickness of its shells, which are so strongly lined and defended that no animal will attempt to pierce them. But though the oyster be secured from the attacks of the small reptiles at the bottom, yet it often serves as an object to which they are attached. Pipe-worms, and other little animals, fix their habitation to the oyster's sides, and in this manner continue to live in security. Among the number of these is a little red worm, that is often found upon the shell; which some, from never seeing oysters copulate, erroneously supposed to be the male by which their spawn was impregnated.

The oyster differs also from the mussel, in being utterly unable to change its situation. The mussel, as we have observed, is capable of erecting itself on an edge, and going forward with a slow laborious motion. The oyster is wholly passive, and endeavours by all its powers to rest fixed to one spot at the bottom. It is entirely without that tongue which we saw answering the purposes of an arm in the other animal; but nevertheless is often attached very firmly to any object it happens to approach. Rocks, stones, pieces of timber, or sea-weeds, all seem proper to give it a fixture, and to secure it against the agitation of the waves. Nothing is so common in the rivers of the tropical climates as to see oysters growing even amidst the branches of the forest. Many trees which grow along the banks of the stream often bend their branches into the water, and particularly the mangrove, which chiefly delights in a moist situation. To these the oysters hang in clusters, like apples upon the most fertile tree; and in proportion as the weight of the fish sinks the plant into the water, where it still continues growing, the number of oysters increase, and hang upon the branches. Thus there is nothing that these shell-fish will not stick to; they are often even found to stick to each other. This is effected by means of a glue

proper to themselves, which, when it cements, the joining is as hard as the shell, and is as difficultly broken. The joining substance, however, is not always of glue; but the animal grows to the rocks, somewhat like the mussel, by threads; although these are only seen to take root in the shell, and not, as in the mussel, to spring from the body of the fish itself.⁴

Oysters usually cast their spawn in May, which at first appear like drops of candle-grease, and stick to any hard substance they fall upon. These are covered with a shell in two or three days; and in three years the animal is large enough to be brought to market. As they invariably remain in the places where they are laid, and as they grow without any other seeming food than the afflux of sea-water, it is the custom at Colchester, and other parts of the kingdom, where the tide settles in marshes on land, to pick up great quantities of small oysters along the shore, which, when first gathered, seldom exceed the size of a sixpence. These are deposited in beds where the tide comes in, and in two or three years grow to a tolerable size. They are said to be better tasted from being thus sheltered from the agitations of the deep; and a mixture of fresh water entering into these repositories, is said to improve their flavour, and to increase their growth and fatness.⁵

The oysters, however, which are prepared in this manner, are by no means so large as those found sticking to rocks at the bottom of the sea, usually called *rock-oysters*. These are sometimes found as broad as a plate, and are admired by some as excellent food. But what is the size of these compared to the oysters of the East Indies, some of whose shells I have seen two feet over! The oysters found along the coast of Coromandel are capable of furnishing a plentiful meal to eight or ten men; but it seems universally agreed, that they are no way comparable to ours for delicacy of flavour.⁶

Thus the mussel and the oyster appear to have but few distinctions, except in their shape and the power of motion in the former. Other bivalved shell-fish, such as the cockle, the scallop,

⁴ Oysters and scallops, it is now known, have a small degree of locomotive power. When left by the tide, they open their shells to the full extent of the hinge, then shut it suddenly with a jerk, by which means it rises a little from the ground, and is carried to some small distance. The scallop will, in this manner, lift itself some inches from the ground, and tumble itself over till it has regained the sea: it can likewise, in a calm sea, float itself on the surface of the water. The Jacobæan scallop is one of the most beautiful of its tribe. It is found rather plentifully in the Mediterranean sea, and sparingly in Britain. It varies very much in point of colouring, and is rather smaller than the common scallop. The valves are unequal, and subarcuated, with fourteen angular, longitudinally-striped rays.—Ed.

⁵ See Supplementary Note A, p. 337.

⁶ The shell here alluded to is probably the *Giant Chama*, a native of the Indian ocean, and the largest shell at present known.—Ed.

and the razor-shell, have differences equally minute. The power of changing place, which some of them effect in a manner quite peculiar to themselves, makes their greatest difference. The scallop is particularly remarkable for its method of moving forward upon land, or swimming upon the surface of the water. When this animal finds itself deserted by the tide, it makes very remarkable efforts to regain the water, moving towards the sea in a most singular manner. It first gapes with its shell as widely as it can, the edges being often an inch asunder; then it shuts them with a jerk, and by this the whole animal rises five or six inches from the ground. It thus tumbles any how forward, and then renews the operation until it has attained its journey's end. When in the water, it is capable of supporting itself upon the surface; and there opening and shutting its shells, it tumbles over and over, and makes its way with some celerity.

The Pivot, or Razor-shell, has a very different kind of motion. As the former moves laboriously and slowly forward, so the razor-shell has only a power of sinking point downward. The shells of this animal resemble nothing so much as the haft of a razor; and by this form it is better enabled to dive into the soft sand at the bottom. All the motions of this little animal are confined to sinking or rising a foot downwards or upwards in the sand, for it never leaves the spot where it first was planted. From time to time it is seen to rise about half-way out of its hole; but if any way disturbed, it sinks perpendicularly down again. Just over the place where the razor buries itself, there is a small hole like a chimney, through which the animal breathes, or imbibes the sea-water. Upon the desertion of the tide, these holes are easily distinguished by the fishermen who seek for it; and their method of enticing the razor up from the depth of its retreat, is by sprinkling a little sea-salt upon the hole. This melting, no sooner reaches the razor below, than it rises instantly straight upwards, and shows about half its length above the surface. This appearance, however, is instantaneous; and if the fisher does not seize the opportunity, the razor buries itself with great ease to its former depth. There it continues secure: no salt can allure it a second time; but it remains unmolested, unless the fisher will be at the trouble of digging it out sometimes two feet below the surface.

Such are the minute differences between bivalved shell-fish; but in the great outlines of their nature they exactly resemble each other. It is particularly in this class of shell-fish that pearls are found in greatest abundance; and it is in the internal parts of those shells that are of a shining silvery colour, that those gems are usually generated; but the pearl is also found to breed as well in the mussel or the scallop as in the oyster. In fact, it is found in all bivalved shells, the insides of which resemble that well-known substance called mother-of-pearl.

Whether pearls be a disease or accident in the animal is scarcely worth inquiry. The common opinion is, that they are a kind of calculese concretion in the body of the animal, somewhat resembling a stone in the bladder, and are consequently to be considered as a disorder. It is said, in confirmation of this opinion, that those coasts upon which pearls are fished, are very unhealthy; and therefore most probably oysters share the general influence of the climate: it is also added, that those oysters in which pearls are found are always ill-tasted, which is a sign of their being unsound: and, lastly, it is asserted, that the pearl grows sometimes so big as to keep the shells of the animal from shutting, and that thus it dies by being exposed. It is easy to see the weakness of these assertions, which seem neither true nor amusing. To answer them in their own way: If a stone in the bladder be a disorder, a stone in the stomach of an ostrich is a benefit, and so it may be in the shell of an oyster. If the shores where the pearls are fished be unwholesome to man, that, instead of being disadvantageous, is so much the more lucky for the oyster. If the pearl oysters are the worst tasted, so are kites and ravens among birds; and yet we know that they are healthy and long-lived animals. If the oyster had ever its shell kept asunder by the pearl within it, that would be a disease indeed; but this, in reality, never happens; for the oyster that breeds a large pearl always breeds a large shell, and the shell itself indents to receive its impression. The pearl upon the whole seems bred from no disorder in the animal, but accidentally produced from the same matter that goes to form the shell. This substance, which is soft at first, quickly hardens; and thus, by successive coats, layer over layer, the pearl acquires its dimensions. If cut through, it will be found to consist of several coats, like an onion; and sometimes a small speck is seen in the middle, upon which the coats were originally formed.

All oysters, and most shell-fish, are found to contain pearls; but that which particularly obtains the name of the pearl oyster, has a large strong whitish shell, wrinkled and rough without, and within smooth and of a silver colour. From these the mother-of-pearl is taken, which is nothing more than the internal coats of the shell, resembling the pearl in colour and consistence. This is taken out and shaped into that variety of utensils which are found so beautiful: but the pearl itself is chiefly prized; being found but in few oysters, and generally adhering; sometimes making a print in the body of the shell, sometimes at large within the substance of the fish.

There are a great number of pearl fisheries in America and Asia; but as pearls bear a worse price than formerly, those of America are in a great measure discontinued. The most famous of all the Asiatic fisheries is in the Persian Gulf,

near the isle of Bahren. There is another between the coast of Madura and the island of Ceylon; and there was a third on the coast of Japan: but as these noble islanders have a contempt for jewels, and an abhorrence for such Europeans as come in pursuit of them, that fishery, which is thought to be the most valuable of all others, is discontinued. The diving business is now carried on only in those countries where the wretchedness of one part of mankind goes to support the magnificence of the other.

The chief fishery, as was said, is carried on in the Persian Gulf, and the most valuable pearls are brought from thence. The value of these jewels increases not only in proportion to their size, but also their figure and colour; for some pearls are white, others yellowish, others of a lead colour; and some affirm they have been found as black as jet. What it is that gives these different tinctures to pearls is not known: Tavernier ascribes it to their lying two or three weeks upon the shore after the oyster is taken; Reaumur thinks it proceeds from the colour of that part of the fish's body upon which the pearl lies. It is most probable that this colour proceeds, like the spots frequently found on the internal surface of the shell itself, from some accident while the pearl is growing.

The best-coloured pearls and the roundest are brought from the East: those of America are neither so white nor so exactly oval. All pearls, however, in time become yellow; they may be considered as an animal substance converted into a stony hardness, and, like ivory, taking a tincture from the air. They have been even found to decay when in damp or vaulted places, and to moulder into a substance scarcely harder than chalk. When the daughters of Stilicon, who were both betrothed, one after the other, to the emperor Honorius, were buried, much of their finery was also deposited with them in the same tomb. In this manner they remained buried for eleven hundred years, till the foundations of the church of St. Peter were laying. Their tomb was then discovered, and all their finery was found in tolerable preservation except their pearls, which were converted by time and damps into a chalky powder.

The wretched people that are destined to fish for pearls, are either negroes or some of the poorest of the natives of Persia. The inhabitants of this country are divided into tyrants and slaves. The divers are not only subject to the dangers of the deep, to tempests, to suffocation at the bottom, to being devoured by sharks, but from their profession universally labour under a spitting of blood, occasioned by the pressure of air upon their lungs in going down to the bottom. The most robust and healthy young men are chosen for this employment, but they seldom survive it above five or six years. Their fibres become rigid; their eye-balls turn red; and they usually die consumptive.

II.

It is amazing how very long they are seen to continue at the bottom. Some, as we are assured, have been known to continue three quarters of an hour under water without breathing; and to one unused to diving, ten minutes would suffocate the strongest. Whether from some effort the blood bursts the old passage which it had in the foetus, and circulates without going through the lungs, it is not easy to tell; but certain it is that some bodies have been dissected with this canal of communication open, and these extraordinary divers may be internally formed in that manner.

Be this as it may, no way of life seems so laborious, so dangerous, or so painful. They fish for pearls, or rather the oysters that contain them, in boats twenty-eight feet long; and of these there are sometimes three or four hundred at a time, with each seven or eight stones, which serve for anchors. There are from five to eight divers belonging to each, that dive one after another. They are quite naked, except that they have a net hanging down from the neck to put their oysters in, and gloves on their hands to defend them while they pick the oysters from the holes in the rocks; for in this manner alone can they be gathered. Every diver is sunk by means of a stone, weighing fifty pounds, tied to the rope by which he descends. He places his foot in a kind of stirrup, and laying hold of the rope with his left hand, with his right he stops his nose to keep in his breath, as upon going down he takes in a very long inspiration. They are no sooner come to the bottom, but they give the signal to those who are in the boat to draw up the stone; which done, they go to work, filling their net as fast as they can; and then giving another signal, the boats above pull up the net loaded with oysters, and shortly after the diver himself, to take a new inspiration. They dive to the depth of fifteen fathoms, and seldom go deeper. They generally go every morning by break of day to this fatiguing employment, taking the land wind to waft them out to sea, and returning with the sea-breeze at night. The owners of the boat usually hire the divers, and the rest of the boat's crew, as we do our labourers, at so much a-day. All the oysters are brought on shore, where they are laid in a great heap, till the pearl fishery is over, which continues during the months of November and December. When opportunity serves, they then examine every oyster, and it is accidental whether the capture turns out advantageous. Indeed no human being can wish well to a commerce, which thus chains such a number of fellow-creatures to the bottom, to pluck up a glittering mouldering pebble.

NOTE A.—*Edible Shell-fish.*

Oysters abound on various parts of the British coast, and are consumed under one form or another, in such numbers, as to have become a valuable article of commerce. The quantity of oysters taken in a season is supposed to be above 20,000 bushels.

V

which are chiefly disposed of in London; but they are also sent to Hamburg, Bremen, Holland, France, and Flanders. So important, indeed, are the oyster-fisheries of Britain, that they have long been an object of attention to the legislature; and they are regulated by a court-of-admiralty. In the month of May, the fishermen are allowed to take the oysters, in order to separate the spawn from the *cultch*,* the latter of which is thrown back, to preserve the bed for the future. After this month it is felony to carry away the cultch, and punishable to take any oyster, unless, when closed, a shilling will rattle between its valves. The spawn is then deposited in beds or 'ayers' formed for the purpose, and furnished with sluices, through which, at the spring-tides, the water is suffered to flow. This water, being stagnant, soon becomes green in warm weather; and, in a short time, the oysters acquire the same tinge, which renders them of greater value in the market. Three years at least are required to bring them to a marketable state; and the longer they remain, the more fat and delicate they become. Those artificial beds, as Pliny informs us, were invented by one Sergius Arata, and first established on the Lucrine Lake, A. U. 660; and, from some circumstances mentioned by the naturalist, we may infer that the said Sergius was no loser by the speculation. In Scotland we have none of them, but eat our oysters just as they are brought from their native rocks; and though certainly inferior to the genuine "Pyedleet," yet they are no despicable dainties.

August 4th is, in metropolitan parlance, 'Oyster-day,' i. e., the day on which oysters are first brought into the London market at Billingsgate. Formerly the commencement of the sale on the 4th was so punctually observed, that the market was opened immediately after the clock had struck twelve on the night of the 3d, when, in the rush to obtain the first supply of oysters, it being dark, a life or two was lost annually. This injudicious practice of opening the market at midnight was, therefore, discontinued, and the time changed to five o'clock in the morning. On Friday [Aug. 4, 1843], says a London journal of the succeeding week, "Billingsgate was crowded with vendors of shell-fish. Mr. Goldham, the clerk of the market, and his assistants, adopted the usual precautions to prevent accidents and robberies. Barriers were erected at convenient distances, and boards inscribed, 'Take care of your pockets,' were displayed. By another regulation of Mr. Goldham—who has completely reformed Billingsgate—the name of the oysters composing each cargo was exhibited on the rigging of each vessel, so that it was impossible to impose on the buyers. The supply was below the average, and the demand was not so brisk as usual. There were fifty sail of vessels at market from Rochester, Whitstable, Essex, and the Cheyney-rock, near the Isle of Sheppey. There was one vessel from Torbay, rather an unusual circumstance. The inferior oysters, which had not been laid on the beds to fatten, produced from 8s. to 10s. per bushel; the 'Commons,' an oyster generally vendible by retail dealers at the stalls, 14s. per bushel; the pearls, £1 12s.; the Kellys, 16s.; and Scotch, £1 10s. There were no supplies from Queenborough or Faversham. Lawsuits have been going on respecting the oyster-fishery at the former place, and the beds at the other are represented to be in a state of bankruptcy. In the evening, other vessels arrived laden with oysters, and the prices were nearly the same. We have not the means at hand of ascertaining the number of vessels at present employed in the

British oyster-fisheries; but in 1840, there were 74 English cutters, and 41 Jersey cutters, of about 20 tons each, besides 24 undecked boats of about 4 tons each, employed for dredging from that island for the English market. Nearly 1,000 fishermen were occupied in these vessels; and 70,000 tubs were exported to England in one season. Again, we find that, in the country of Essex alone, 15,000 bushels of oysters have been bred and taken in one year.

"Every schoolboy remembers how this little island, now the mistress of the world, is referred to in classic history by the Romans, then the world's masters, for the exquisite delicacy of its oysters. Not, however, satisfied with the native delicacy of our oysters, the epicures of old Rome fattened them in pits and ponds: they iced them before eating them; and one Montanus, a gourmet of great celebrity, could tell the breed of an oyster by the first bite! The locality whence these luxurious fellows obtained the finest oysters has been precisely ascertained: it was from Rutupia (Richborough), near Sandwich, in Kent, once a harbour and city of note, but now a solitary ruin. The finest oysters in the world are found in England. This is acknowledged even by the French, who are ever ready to dispute our national claims; for, in a brochure published in Paris, and entitled 'Le Manuel de l'Amateur des Huitres,' the British oysters are stated to be the best.

"It would not be difficult to pile up a mass of facts in the economy, natural and artificial, of oysters. Of the British coasts, the most famous for their oysters are the shores of Kent and Essex. Those found near Milton, in Kent, or 'natives,' are, perhaps, the very best; they are small, round, plump, and white, and have thin shells, which are easily opened. Next are the beds at Queenborough, in the Isle of Sheppey, and at Whitstable, opposite. In dredging at the latter place, round a rock now called 'the Pudding-pan,' great quantities of Roman pottery have been discovered. In the creeks and inlets of the Medway, are many valuable oyster-fisheries, which are under the jurisdiction of the corporation of Rochester; and a court-of-admiralty, consisting of the mayor and aldermen, assisted by a jury of free dredgers, possess the power of making regulations relative to the oyster-bed, and the seasons for fishing. The oysters found in the river Colne, on which stands Colchester, in Essex, are also of excellent quality. Massinger has made them classical by causing Justice Greedy, in 'A New Way to Pay Old Debts,' to say that he had nothing to speak of this morning before breakfast, except a barrel of Colchester oysters. The Colne here forms a great many arms and creeks, exceedingly well-suited for the formation of oyster-banks. The Dorsetshire oysters rank next in estimation to those of Essex, and those of Poole are in high repute; as are those of the Isle of Wight, and of Tenby, on the coast of South Wales; and the finest pickled oysters are sent from Milford-haven. Besides the oysters on the English shores, oyster-banks are common on the northern coasts of Ireland. Edinburgh was, till lately, plentifully supplied with good oysters from the frith of Forth. Nearly opposite to Leith was a large dépôt of oysters, formed around or near the islet of Inchkeith. Dublin is supplied with oysters from Arklow, a little to the east; and oysters are conveyed thence to artificial beds near the city, on the northern side. In parting with the varieties of oysters, we must not forget the famous oysters taken in the Mossul-bay, at the Cape of Good Hope, to eat which, epicures come four hundred miles from the interior!

"The European oyster is found adhering to rocks and stones, or, occasionally, to very strong clayey bottoms; and, should these be washed away, the oyster beds perish. The fish is viviparous, and the young are produced with a perfectly formed shell.

* By this term are meant the stones, gravel, old shells, &c., to which the spawn adheres; and the reason for punishing its destruction is, that, when taken away, the ooze increases, and mussels and cockles breed on the bed, and destroy the oysters, gradually occupying all the places on which the spawn should be cast.

They are, when first emitted, quite transparent, and they swim rapidly by means of a membrane extending out of the shell. They are very delicate creatures; for, during the severe winter of 1840-41, millions of young oysters were destroyed by the frosts. It was formerly supposed that the fish fattened during full moon, and grew thin as it waned; we are not aware that this has been observed in the present day, but it may have happened in particular situations, owing to the difference in the tides. The vulgar opinion, and that on which the restraining laws have been formed is, that the period of spawning is May, at which time the young, or *spat*, is found adhering to the rocks. But, as the young are found in the parents perfectly formed and alive in the month of August, this is most probably the period of parturition, though it be not till May that they become fixed, or sufficiently grown to be seen by the common observer. At this time, they are about the size of a sixpence, comparatively hard and firm, and have been well compared to a drop of candle-grease in water. In two, or, at farthest, three years, they are fit for table. The oyster probably attains a great age; but, after having arrived at its full size, the valves are thickened, instead of being increased in length or breadth. From May to July, both the male and female oyster are said to be sick, and are in thin and poor condition; but, by the end of August they have again recovered, are fat, and in season. The sexes are distinguished by the fishermen by the colour of the fringe; that of the male being black or dark-coloured, that of the female white. The shell is formed of carbonate of lime and animal gluten; and the oyster frequently contains shining intestinal worms, which may be seen by opening the shell in the dark. The sea-star is very destructive in an oyster-bed: it clasps its rays round the shell, and perseveres until it has sucked out the inhabitant. Another enemy to the oyster is said to be the mussel. The time allowed for collecting oyster-spawn from the sea is May, when the dredgers, as the fishermen are termed, may take all they can procure; but after that month it is felony to disturb the spawn. They dredge it up, when, if not too small, they separate it from the shells and stones to which it is adhering; and these they are obliged to throw into the water, to prevent the beds being destroyed. The spawn or *spat* is then thrown into creeks or into shallow water on the shores to increase in size and fatten, and in such situations is considered private property. The dredgers use a peculiar kind of net, which is very strong, and fastened to three spikes of iron; this they drag along the bottom of the sea, and thus force the oysters into it; each boat requires five men, and they dredge in water from four to fifteen fathoms deep.

"Oysters are conceitedly said to be in season in every month of the year that has an *r* in its name, beginning with September, and ending with April. But this error was practically refuted so long ago as the year 1804, when M. Balaine contrived the means of sending to Paris, oysters fresh, and in the best possible order, at all seasons alike. Balaine's predecessor in his art was Apicius, who is said to have supplied Trajan with fresh oysters at all seasons of the year; and Apicius deserved an immortal character for such a triumph. Still, we do not enjoy this refinement in England; though the common notion is exploded, by oysters being very fine in August."

The oyster is a bivalve shell, and there are many others of this kind which are edible. Indeed, none of them, so far as we know, are positively hurtful; though some, as the Spondyli, are harsh and disagreeable, others occasionally act as poison at particular seasons or to peculiar constitutions, and many are so small or so rare as never to have been used. The *Pecten maximus*, for example, is a much esteem-

ed species; and the clam (*Pecten opercularis*) is very commonly eaten in Scotland. The *Anomia undulata*, at Bourdeaux, is considered a delicacy; while, on some parts of the shores of the Mediterranean, the rocks are broken with large hammers, in order to procure the *Pholas dactylus*, which abounds there, and is admired even at the tables of the luxurious. The razor-fish (*Solen siliqua*), common on our sandy shores, is an article of food in many places; and when they go to its capture, the Irish are said to have a song appropriate to the occasion, whence we may infer it is a favourite with them. On a dish made of the animal of the *Mya truncata*, and named *smurshin*, the natives of Orkney and Zetland delight to sup; and from many parts of the coast of England, great number of cockles (*Cardium edule*) are gathered, particularly in spring; and in autumn, an equal number of mussels, which are eaten roasted or pickled, or by entering into the composition of sauces, add to the *gout* of more substantial viands.

This catalogue, were it necessary, might easily be extended; but it may be sufficient, in addition, to remark, that almost every shore has some species peculiar to it, or more plentiful than elsewhere, which the natives make subservient to the table. Thus, in India, the favourite food *baccassan* is prepared from the *Tellina gari*; and in South America they use a large mussel, eight inches long, and of excellent flavour. They are often salted and dried; after which, they are strung on slender rushes, and in this manner large quantities are exported. A similar practice is adopted by the Africans in the neighbourhood of the river Zaire or Congo. They take large quantities of a species of *Mya* from out the mud round Kampenzy Island, and as in a raw state the animals are without flavour, they stick them on wooden skewers, as the French do frogs, and half dry them. They pass thus into a state of semiputrefaction, become entirely to the taste of the negroes, and form an important object of traffic. The natives of New Holland and New Zealand did, at the time of their discovery, use the *Chama gigas*, a very large shell, a pair of the valves of which were presented, as natural curiosities, to Francis I. by the Venetians; and which Louis XV., more zealous, as he has himself taken care to let us know, for the glory of God destined to hold holy water in the magnificent church of St. Sulpice in Paris, where they to this day actually serve the purpose of baptismal fonts. Captain Cook tells us that it sometimes attains a size so great that two men are required to carry it; and containing full 20 lbs. of good meat, it often furnished him and his fellow-adventurers an esteemed repast. Bruce mentions the same species as being found in the Red sea, but in this respect he is probably mistaken. The fish of his shell, however, are very wholesome, and have a *peppery* taste, a circumstance so much the more convenient, that they carry that ingredient of spice along with them for sauce, with which travellers seldom burden themselves.

Of the univalved shells, the periwinkle (*Turbo littoreus*) and common whelk (*Buccinum lapillus*) frequently furnish to the poorer classes of our sea-coast towns and villages a repast, perhaps sufficiently wholesome, and certainly not destitute of relish. But, even to them these may be regarded merely in the light of luxuries: it is far otherwise with the still poorer inhabitants of several of the Western Isles of Scotland. Periwinkles and limpets (*Patella vulgata*), which so profusely stud the rocks of their shores, are their daily fare, and on which they are sometimes reduced to the necessity of altogether subsisting. In the Isle of Skye, for example, we are told that there is almost annually a degree of famine, when the poor are left to Providence's care, and prowl, like other animals, along the shores, to

pick up limpets and other shell-fish: "the casual repast," adds Mr. Pennant, "of hundreds, during part of the year, in these unhappy islands."

Some shell-fish are poisonous when eaten. This is frequently the case with mussels. They are known to produce an itchy eruption and swelling over the whole body, attended with great anxiety and considerable fever. On some parts of the Yorkshire coast they are considered poisonous, and in consequence never eaten; and several cases are on record in which their use proved fatal. Some of Captain Vancouver's men having breakfasted on roasted mussels, were soon after seized with a numbness about their faces and extremities; their whole bodies were shortly affected in the same manner, attended with sickness and giddiness, and one died. In the month of June 1827, a great number of the poor in Leith were poisoned by eating these shell-fish, which they procured from the docks. "The town," says Dr. Combe, "was in a ferment, and the magistrates, with great propriety, issued a warning against the use of the mussels. Many deaths were reported, and hundreds of individuals were stated to be suffering under it. Luckily, matters were not so deplorable; but we ascertained that, in addition to the man mentioned before, the companion of our patient, an elderly woman, had died. In all, about thirty cases occurred, with great uniformity of symptoms, but varying very much in severity: but none, so far as I know, have left any permanent bad effects." To what cause these deleterious effects are to be ascribed is uncertain; for mussels may commonly be eaten with impunity. Some attribute them to disease in the fish, or to its being in a state of putrefaction; others to its having fed on some poisonous articles, more particularly on the ores of copper; and others, again, to the peculiar idiosyncracies of the sufferers. In many cases this latter explanation will suffice; but sometimes, as in the Leith cases, it is obviously insufficient. The disease of the fish has never been satisfactorily ascertained: they are eaten fresh and alive, and cannot, of course, be putrid; while the most delicate chemical tests give no indications of cupreous impregnation. Upon the whole, the effects seem to be best explained by attributing them to a peculiar poison generated in the fish, under unknown circumstances; an opinion adopted by those medical men who have attended most to the subject.

A very common and very mistaken opinion exists, especially among foreigners, that all English oysters are impregnated with copper, 'which they get from feeding off copper banks;' such would be quite as injurious to the animal itself as it could be to us, and the fancy could only have arisen from the strong flavour peculiar to green oysters. This matter has, however, been taken up by scientific men; for M. Valenciennes, in a paper on the Colorisation of the Green Oyster, maintains that the green colour lies in the four divisions of the bronchiæ, and in the intestinal canal.

NOTE B.—Pearl-fisheries.

Several species of bivalved shell-fish produce pearls, but the greater number, the finest and the largest, are procured from the *Meleagrina margaritifera* of Lamarck, a native of the sea, and of various coasts. A considerable number are likewise taken from the *Unio margaritifera*, which inhabits the rivers of Europe; and it is singular, as remarked by Humboldt, that though several species of this genus abound in the rivers of South America, no pearls are ever found in them. The pearls are situated either in the body of the oyster, or they lie loose between it and the shell, or, lastly, they are fixed to the latter by a kind of neck; and it is said they do not ap-

pear until the animal has reached its fourth year. They have a beautiful lustre, but there is nothing peculiar in their chemical composition, consisting merely of carbonate of lime.

The Romans were extravagantly fond of these ornaments, which claimed the first rank after the diamond; and they gave almost incredible prices for them. Julius Cæsar presented Servilia, the mother of M. Brutus, with a pearl worth £48,417 10s.; and Cleopatra, at a feast with Antony, of which Pliny has given a long and interesting account, swallowed one dissolved in vinegar of the value of £80,729 3s. 4d. They wore them in great profusion, not only in the ears, and on the fingers, head, and neck, but strung over the whole body; and the men as well as the ladies were thus adorned. The principal fisheries of this people were in the Red sea, the Gulf of Persia, and the Indian ocean, the pearls of the former places being the most highly valued as superior in size and lustre; and it is matter of history that Cæsar was induced to invade Britain from some exaggerated accounts he had heard of the pearls of our coasts, or rather of our rivers; but if these were his object he was disappointed, for they were found to be of a bad colour and inferior size, nor have they improved in their reputation.

Ceylon continues to be, as it was in the time of the Romans, the most productive of these ornaments. The ancient fisheries in the Red sea, however, are now either exhausted or neglected, and cities of the greatest celebrity have in consequence sunk into insignificance or total ruin. Dabalac was the chief port of the pearl trade on the southern part of the Red sea, and Suakem on the north; and under the Ptolemies, or even long after, in the time of the caliphs, these were islands whose merchants were princes: but their bustle and glory have long since departed, and they are now thinly inhabited by a race of miserable fishermen. Nor are the rivers of Britain now fished, nor were they at any time of much value in this respect. Good pearls have indeed been occasionally found in our river-mussel, but too seldom to be worth the search. A notion prevails that Sir Richard Wynn of Gwydir, chamberlain to Catherine, queen of Charles II., presented Her Majesty with one taken in the Conway, which is to this day honoured with a place in the regal crown. In the same river there are still some poor people who employ themselves in searching for pearls. In the last century several of great size were gotten in the rivers of the counties of Donegal and Tyrone, in Ireland. One that weighed 36 carats was valued at £40, but being foul lost much of its worth. Other single pearls were sold for £4 10s., and even for £10. The last was sold a second time to Lady Glenleah, who put it into a necklace, and refused £80 for it from the Duchess of Ormond. In his tour in Scotland, in 1769, Mr. Pennant mentions a considerable pearl-fishery in the vicinity of Perth, from which £10,000 worth was sent to London, from 1761 to 1799; but, by the indiscriminate destruction of the mussels, the fishery was soon exhausted.

After the discovery of America the traffic in pearls passed, in a great measure, from the east to the shores of the western world. The first Spaniards who landed in Terra Firma found the savages decked with pearl necklaces and bracelets; and among the civilized people of Mexico and Peru they saw pearls of a beautiful form as eagerly sought after as in Europe. The hint was taken; the stations of the oysters were sought out; and cities rose into splendour and affluence in their vicinity, all supported by the profits of these sea-born gems. The first city which owed its rise to this cause was New Cadiz, in the little island of Cubagua; and the writers of that period discourse eloquently of the riches of the first planters, and the luxury they displayed: but now not a vestige of the

city remains, and downs of shifting sand cover the desolate island. The same fate soon overtook the other cities; for from various causes, and particularly from the never-ceasing and indiscriminate destruction of the Meleagrine, the banks became exhausted, and towards the end of the sixteenth century this traffic in pearls had dwindled to insignificance.

At present Spanish America furnishes no other pearls for trade than those of the Gulf of Panama and the mouth of the Rio de la Hacha. The bulk of them are procured from the Indian ocean, particularly from the bay of Condeatchy in Ceylon. The fishery in that station is conducted with an eye to the future. The banks, which extend several miles along the coast, are divided into three or four portions, and fished in succession; a repose of three or four years being thus given to the animals to grow and propagate. Further, the beds are carefully surveyed, and the state of the oysters ascertained, previously to their being let or farmed; and the merchant is permitted to fish them for only six or eight weeks; but from the number of holidays observed by the divers of different sects and nations, the fishing days do not in reality much exceed thirty. The fishing-season commences in February, and ends about the beginning of April. During its continuance, there is no spectacle which Ceylon affords more striking to a European than the bay of Condeatchy.

About seven years is the maximum age of the pearl-oyster, but after six years they are apt to die suddenly in vast quantities. The nearer to seven years that they are fished the richer is the harvest; if they live beyond that period the pearl loses its rich lustre. From 1799 to 1820 there were eleven fisheries at Ceylon, which produced £297,103 10s. 3d., and from 1820 to 1837 there were nine fisheries, producing £227,131 13s. 3d. Thus twenty fisheries realized upwards of half-a-million of nett revenue. The time for inspecting the banks is in the lulls between the monsoons in October and November, and the fishery always takes place at the change in March and April. A fishery used to create the utmost excitement along the whole coast of India, and as many as 4,000 or 5,000 people have congregated about the barren shores of Aripo, which means a *sieve*, and which appears to derive its name from the sifting and sorting the pearls, through a succession of 10 or 12 brass cullenders of the size of a large saucer. The largest holes are in the one at the top, and the lower the pearl falls the less is its value. The days for fishing are not only limited, but the hours, as well as the number of boats and divers. They fish up everything they come across, and there is little time to discriminate, as their time is so valuable; it has sometimes been at the average rate of £6 per minute! The most suitable depth of water appears to be from six to seven fathoms, and the divers seldom remain below so long as a minute; although for payment, or as a trial of strength, some of them have remained much longer, and they bring up about fifty oysters at a time. Among the numerous frequenters and officials at a fishery, a shark-charmer is an indispensable attendant, though accidents from sharks are unknown. The office has been hereditary for several generations. He gets 9d. a-day from Government, to assure the divers that he has secured the mouths of the sharks, and driven them from the banks.

Linnaeus in part owed his elevation to nobility to a discovery he made of causing the fresh-water mussel (*Unio margaritifera*) of Sweden to produce pearls at his pleasure. It is conjectured that he accomplished this by drilling small holes through the shells, but his method is not certainly known, nor is this of any consequence, since it seems to have been soon abandoned. The States of Sweden viewed it at first in such an important light that they rewarded

the illustrious naturalist with a premium of 1,800 dollars (about £450), which in that country must have been a very considerable sum.

CHAP. VII.

OF MULTIVALVE SHELL-FISH.

MULTIVALVE shell-fish may be considered as animals shut up in round boxes. To view their habitations externally, one would be little apt to consider them as the retreats of living creatures; and still less, to suppose that some of them carry their boxes with a tolerable share of swiftness, so as to escape their pursuers. Of these there are principally two kinds; such as move, and such as are stationary: the first are usually known in our cabinets by the name of Sea-eggs; the others are as often admired, from the cavities which they scoop out for their habitation in the hardest marble. The first are called by naturalists, Echini, or Urchins;¹ the latter are called Pholades, or File-fish. Of both there are several sorts; but, by describing these two, we shall have a competent idea of all the rest.

On a slight view, the sea-urchin may be compared to the husk of a chestnut; being like it round, and with a number of bony prickles standing out on every side. To exhibit this extraordinary animal in every light—if we could conceive a turnip stuck full of pins on every side, and running upon these pins with some degree of swiftness, we should have some idea of this extraordinary creature. The mouth is placed downwards; the vent is above; the shell is a hollow vase, resembling a scooped apple; and this filled with a soft muscular substance, through which the intestines wind from the bottom to the top. The mouth, which is placed undermost, is large and red, furnished with five sharp teeth, which are easily discerned. The jaws are strengthened by five small bones, in the centre of which is a small fleshy tongue; and from this the intestines make a winding of five spires, round the internal sides of the shell, ending at the top, where the excrements are excluded. But what makes the most extraordinary part of this animal's conformation, are its horns and its spines, that point from every part of the body, like the horns of a snail, and that serve at once as legs to move upon, as arms to feel with, and as instruments of capture and defence. Between these horns it has also spines that are not endowed with such a share of motion. The spines

¹ The sea-urchins are very improperly placed in the multivalve division of shells, as they are very different from testaceous worms, not only in their functions, but also in the composition of their shells. They are placed by naturalists in the crustaceous order, the shells or crusts of Echini being composed of phosphate of lime with animal matter; those of the testaceous shells being carbonate of lime.—Ed.

and the horns issue from every part of its body; the spines being hard and prickly; the horns being soft, longer than the spines, and never seen except in the water. They are put forward and withdrawn like the horns of a snail, and are hid in the bases of the spines, serving, as was said before, for procuring food and motion. All this apparatus, however, is only seen when the animal is hunting its prey at the bottom of the water; for a few minutes after it is taken, all the horns are withdrawn into the body, and most of the spines drop off.

It is generally said of insects, that those which have the greatest number of legs always move the slowest: but this animal seems to be an exception to the rule; for though furnished with two thousand spines, and twelve hundred horns, all serving for legs, and from their number seeming to impede each other's motion, yet it runs with some share of swiftness at the bottom, and it is sometimes no easy matter to overtake it. It is often taken upon the ebb, by following it in shallow water, either in an osier basket, or simply with the hand. Both the spines and the horns assist its motion; and the animal is usually seen running with the mouth downward.

Some kinds of this animal are as good eating as the lobster; and its eggs, which are of a deep red, are considered as a very great delicacy. But of others the taste is but indifferent; and in all places, except the Mediterranean, they are little sought for, except as objects of curiosity.

Very different in motion, though not much different in shape, from these, are the Acorn shell-fish,² the Thumb-footed shell-fish, and the imaginary Barnacle.³ These are fixed to one

² The bell-acorn shell is found in groups on rocks, or on large shells, where more than fifty have been found in a single cluster. They have been observed in the European ocean, on the coast of Denmark, and the Indian and West Indian seas. They are often attached in such abundance to the bottoms of vessels from foreign countries, that many hundreds have been taken from a single ship.—ED.

³ The shell of the *Windpipe Barnacle* consists of a cylindrical tube somewhat bent, and narrowing a little towards the base. It is open at bottom, but the top is closed by an operculum of four smooth valves, surrounded by a fleshy collar, which connects it with the shell: both ends are orbicular, and the sides are divided into six compartments, or valves, by as many smooth and narrow bands. The ribs on the outside of the shell are very strong, and have sometimes smaller ones between them. The shell is of a cellular substance, regularly striated longitudinally. It is of a tawny colour, with a white inside. These curious productions inhabit the back of the South Sea whale, where they bury themselves in the skin and fat. Dufresne observes, that the animal, independent of its other parts, is furnished with a collar lightly striated, which secretes the testaceous matter for the formation of the rings. In proportion as new rings are formed, the animal buries itself deeper in the fat of the whale, insomuch that two rings are all that are at any time visible above the skin, the rest of the shell being firmly secured in its situation by the help of its annulated surface. These shells are generally about an inch long; but as their

spot, and appear to vegetate from a stalk. Indeed, to an inattentive spectator, each actually seems to be a kind of fungus that grows in the deep, destitute of animal life, as well as motion. But the inquirer will soon change his opinion, when he comes to observe this mushroom-like figure more minutely. He will then see that the animal residing within the shell has not only life, but some degree of voraciousness; that it has a cover, by which it opens and shuts its shell at pleasure; that it has twelve long crooked arms, furnished with hair, which it thrusts forth for its prey; and eight smaller, which are generally kept in the shell. They are seen adhering to every substance that is to be met with in the ocean; rocks, roots of trees, ships' bottoms, whales, lobsters, and even crabs, like bunches of grapes clung to each other. It is amusing enough to behold their operations.⁴ They for some time remain motionless within their shell; but when the sea is calm, they are seen opening the lid, and peeping about them. They then thrust out their long neck, look round them for some time, and then abruptly retreat back into their box, shut their lid, and lurk in darkness and security. Some people eat them; but they are in no great repute at the tables of the luxurious, where their deformed figure would be no objection to their being introduced.

Of all animals of the shelly tribe, the Pholades are the most wonderful. From their great powers of penetration, compared with their apparent imbecility, they justly excite the astonishment of the curious observer. These animals are found in different places; sometimes clothed in their proper shell, at the bottom of the water; sometimes concealed in lumps of marly earth; and sometimes lodged, shell and all, in the body of the hardest marble. In their proper shell they assume different figures; but in general they somewhat resemble a mussel, except that their shell is found actually composed of five or more pieces, the smaller valves serving to close up the openings left by the irregular meeting of the two principal shells. But their penetration into rocks, and their residence there, makes up the most wonderful part of their history.

This animal, when divested of its shell, resem-

growth is progressive, depending upon their age, they have been found of three times the usual length.

The shell of the *Duck Barnacle* is compressed, with five obsoletely striated valves, the lower ones somewhat triangular, the superior ones long, and tapering to an obtuse point. The valves are connected by a cartilage of an orange colour, and affixed to a peduncle from half an inch to a foot in length. It is of a scarlet or orange colour. This shell is generally affixed to rotten wood, the bottoms of vessels, &c., and is an inhabitant of all seas. A superstitious notion has prevailed that the barnacle goose was produced from this shell; and even to this day, in many parts of the Western Highlands of Scotland, the lower class of people firmly believe in this ridiculous transformation.—ED.

⁴ Anderson's History of Greenland.

bles a roundish soft pudding, with no instrument that seems in the least fitted for boring into stone, or even penetrating the softest substances. It is furnished with two teeth indeed; but these are placed in such a situation as to be incapable of touching the hollow surface of its stony dwelling: it has also two covers to its shell, that open and shut at either end; but these are totally unserviceable to it as a miner. The instrument with which it performs all its operations, and buries itself in the hardest rocks, is only a broad fleshy substance, somewhat resembling a tongue, that is seen issuing from the bottom of its shell. With this soft yielding instrument, it perforates the most solid marbles; and having, while yet little and young, made its way, by a very narrow entrance, into the substance of the stone, it then begins to grow bigger, and thus to enlarge its apartment.

The seeming unfitness, however, of this animal for penetrating into rocks, and there forming a habitation, has induced many philosophers to suppose that they entered the rock while it was yet in a soft state, and from the petrifying quality of the water, that the whole rock hardened round them by degrees. Thus any penetrating quality, it was thought, was unjustly ascribed to them, as they only bored into a soft substance, that was hardened by time. This opinion, however, has been confuted, in a very satisfactory manner, by Dr. Bohadsch, who observed that many of the pillars of the temple of Serapis at Puteoli were penetrated by these animals. From thence he very justly concludes, that the pholades must have pierced into them since they were erected; for no workmen would have laboured a pillar into form, if it had been honey-combed by worms in the quarry. In short, there can be no doubt but that the pillars were perfectly sound when erected; and that the pholades have attacked them, during the time in which they continued buried under water, by means of the earthquake that swallowed up the city.⁵

From hence it appears that, in all nature, there is not a greater instance of perseverance and patience than what this animal is seen to exhibit. Furnished with the bluntest and softest auger, by slow successive applications, it effects what other animals are incapable of performing by force; penetrating the hardest bodies only with its tongue. When, while yet naked, and very small, it has effected an entrance, and has buried its body in the stone, it there continues for life at its ease; the sea-water that enters at the little aperture supplying it with luxurious plenty. When the animal has taken too great a quantity of water, it is seen to spurt it out of its hole with some violence. Upon this seemingly thin diet it quickly grows larger, and soon finds itself under a necessity of enlarging its habitation and its shell. The motion of the

pholas is slow beyond conception; its progress keeps pace with the growth of its body; and, in proportion as it becomes larger, it makes its way farther into the rock. When it has got a certain way in, it then turns from its former direction, and hollows downward; till it last, when its habitation is completed, the whole apartment resembles the bowl of a tobacco-pipe; the hole in the shank being that by which the animal entered.

Thus immured, the pholas lives in darkness, indolence, and plenty; it never removes from the narrow mansion into which it has penetrated; and seems perfectly content with being enclosed in its own sepulchre. The influx of the sea-water that enters by its little gallery satisfies all its wants; and, without any other food, it is found to grow from seven to eight inches long, and thick in proportion.

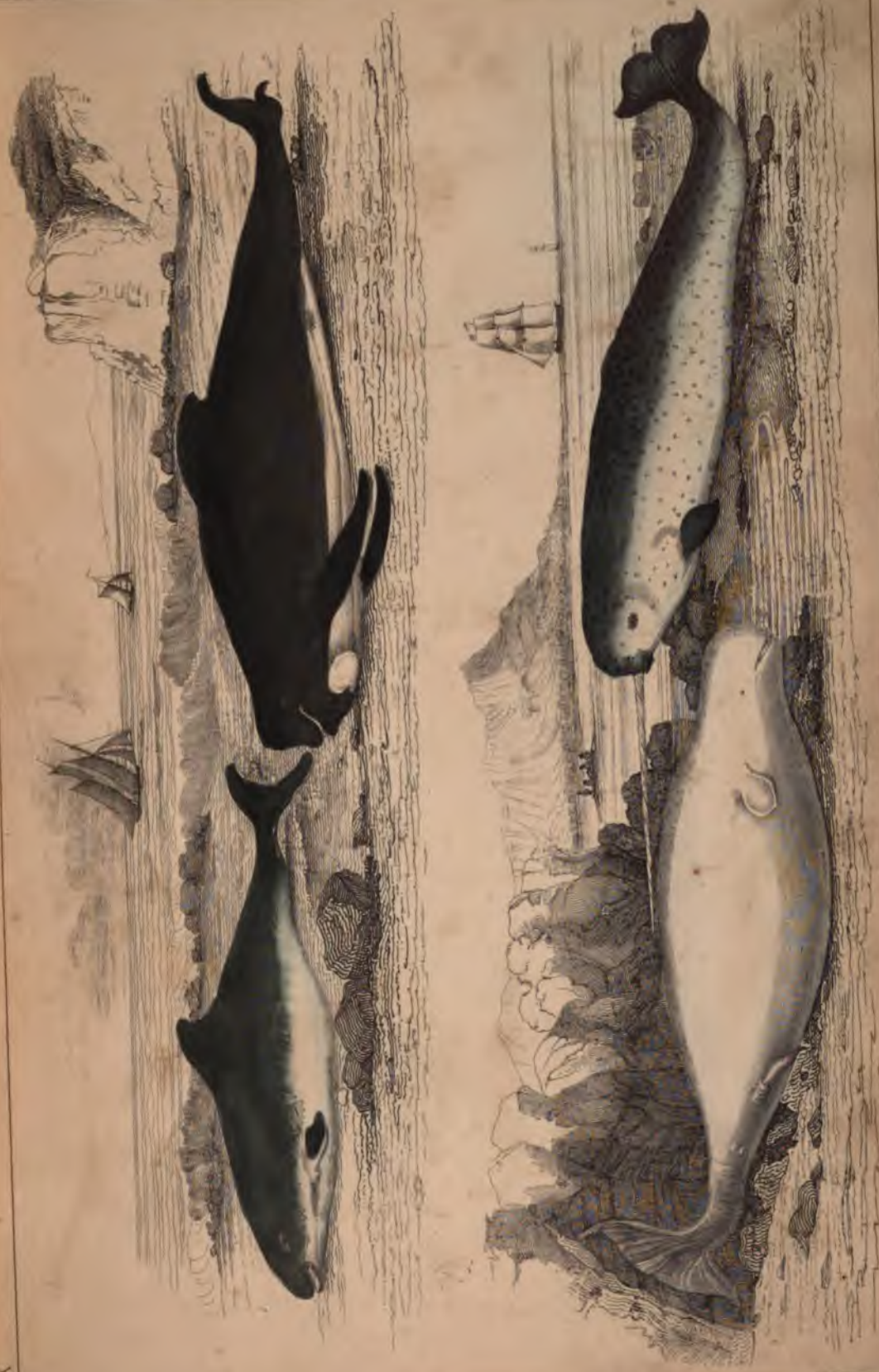
But they are not supplied only with their rocky habitation; they have also a shell to protect them: this shell grows upon them in the body of the rock, and seems a very unnecessary addition to their defence, which they have procured themselves by art. These shells take different forms, and are often composed of a different number of valves: sometimes six, sometimes but three; sometimes the shell resembles a tube with holes at either end, one for the mouth, and the other for voiding the excrements.

Yet the pholas, thus shut up, is not so solitary an animal as it would at first appear; for though it is immured in its hole without egress, though it is impossible for the animal, grown to a great size, to get out by the way it made in, yet many of this kind often meet in the heart of the rock, and like miners in a siege, who sometimes cross each other's galleries, they frequently break in upon each other's retreats. Whether their thus meeting be the work of accident or of choice, few can take upon them to determine: certain it is, they are most commonly found in numbers in the same rock; and sometimes above twenty are discovered within a few inches of each other.

As to the rest, this animal is found in greatest numbers at Ancona, in Italy; it is found along the shores of Normandy and Poitou, in France; it is found also upon some of the coasts of Scotland: and, in general, is considered as a very great delicacy at the tables of the luxurious.⁶

⁵ Most of the Pholades contain a phosphorescent fluid, of great splendour and brilliancy in the dark, and which illuminates whatever it touches or happens to fall upon. They are generally on rocky shores with a bed of sand, just below high-water mark, with their heads a little lifted above the surface, by which they may be easily drawn from their holes. Contrary to the nature of other fish, which give light when they tend to putrescence, this is more luminous the fresher it is; and when dried, its light will revive on being moistened either with salt water or fresh; brandy, however, immediately extinguishes it.—ED.

⁶ Bohadsch de Animalibus Marinis, p. 153.









A HISTORY OF
THE EARTH AND ANIMATED NATURE.

PART FIFTH.
HISTORY OF ANIMATED NATURE.
FROGS, LIZARDS, AND SERPENTS.

CONTENTS OF PART FIFTH.

Book I. Of Frogs and Toads, - - - - -	Page 347
Book II. Of the Lizard kind, - - - - -	361
Book III. Of Serpents, &c., - - - - -	377

HISTORY OF ANIMATED NATURE.

PART FIFTH.—OF FROGS, LIZARDS, AND SERPENTS. *

BOOK I.

OF FROGS AND TOADS.

CHAP. I.

OF FROGS AND TOADS IN GENERAL.

IF we emerge from the deep, the first and most obvious class of amphibious animals that occur upon land are frogs and toads. These, wherever they reside, seem equally adapted for living upon land, and in the water, having their hearts formed in such a manner as to dispense with the assistance of the lungs in carrying on the circulation. The frog and the toad, therefore, can live several days under water, without any danger of suffocation; they want but little air at the bottom; and what is wanting is supplied by lungs, like bladders, which are generally distended with wind, and answer all the purposes of a reservoir from whence to breathe.

To describe the form of animals so well known would be superfluous; to mark those differences that distinguish them from each other may be necessary. The frog moves by leaping; the toad crawls along the ground: the frog is, in general, less than the toad; its colour is brighter, and with a more polished surface; the toad is brown, rough and dusty. The frog is light and active, and its belly comparatively small; the toad is slow, swollen, and incapable of escaping. The frog, when taken, contracts itself so as to have a lump on its back; the toad's back is straight and even. Their internal parts are nearly the same, except that the lungs of the toad are more compact than those of the frog; they have fewer air-bladders, and of consequence the animal is less fitted for living under water. Such are the differences with respect to figure and conformation; their habitudes and manners exhibit a greater variety, and require a separate description.

CHAP. II.

OF THE FROG, AND ITS VARIETIES.

THE external figure of the frog is too well known to need a description. Its power of taking large leaps is remarkably great, compared to the bulk of its body. It is the best swimmer of all four-footed animals; and nature hath finely adapted its parts for those ends, the arms being light and active, the legs and thighs long, and furnished with very strong muscles.

If we examine this animal internally, we shall find that it has a very little brain for its size; a very wide swallow; a stomach seemingly small, but capable of great distension. The heart in the frog, as in all other animals that are truly amphibious, has but one ventricle; so that the blood can circulate without the assistance of the lungs, while it keeps under water. The lungs resemble a number of small bladders joined together, like the cells of a honey-comb: they are connected to the back by muscles, and can be distended or exhausted at the animal's pleasure. The male has two testiculi lying near the kidneys; and the female has two ovaries lying near the same place; but neither male nor female have any of the external instruments of generation; the anus serving for that purpose in both. Such are the most striking peculiarities in the anatomy of a frog; and in these it agrees with the toad, the lizard, and the serpent. They are all formed internally pretty much in the same manner, with spongy lungs, a simple heart, and are destitute of the external instruments that serve to continue the kind.

Of all those who have given histories of the frog, Mr. Roessel, of Nuremberg, seems the most accurate and entertaining. His plates of this animal are well known; his assiduity and skilfulness in observing its manners are still more deserving our esteem. Instead, therefore, of following any other, I will take him for my guide; and though it be out of my power to amuse the reader

with his beautiful designs, yet there will be some merit in transcribing his history.

The common brown frog begins to couple early in the season, and as soon as the ice is thawed from the stagnating waters. In some places the cold protracts their genial appetite till April; but it generally begins about the middle of March. The male is usually of a grayish brown colour; the female is more inclining to yellow speckled with brown. When they couple, the colours of both are nearly alike on the back; but as they change their skins almost every eighth day, the old one falling off in the form of mucus, the male grows yellower, and the female more brown. In the males the arms and legs are much stronger than in the females; and at the time of coupling, they have upon their thumbs a kind of fleshy excrescence, which they fix firmly to the breast of the female. This Linnæus supposed to be the male instrument of generation; but, by closer inspection, it is found only of service in holding the female in a more strict embrace. It may be cut off, and the impregnation continue unimpaired: it is sometimes found in the opposite sex; and some of the males are found entirely without it; however, when it is cut off, the male cannot hold the female so strongly as before.

The sexes couple only once a-year: and then continue united sometimes for four days together. At this time they both have their bellies greatly swollen; that of the female being filled with eggs; the male having the skin of the whole body distended with a limpid water, which is ejected in impregnation. As soon as the male has leaped upon the female, he throws his fore legs round her breast, and closes them so firmly, that it is impossible, with the naked hands, to loose them. The male clasps his fingers between each other, in the same manner as people when they are praying; the thumbs press with their thickest sides against the breast of the female; and though she should struggle ever so much, nothing can induce him to let go his hold. The grasp seems involuntary and convulsive; they cannot be easily torn asunder; and they swim, creep, and live united, for some days successively, till the female hath shed her spawn, which, at length, she does almost in an instant. But how the impregnation is performed, without any apparent instruments of generation, has long been an object of inquiry; and still continues in great obscurity. To investigate the difficulty as carefully as possible, our German philosopher continued to examine their mutual congress for three years together, and availed himself of all the lights that the knife, or analogy, could furnish.

After having chosen twelve couple of frogs that were thus joined to each other, and having placed each couple in a glass vessel with water, he scarcely let them out of his sight day or night, and even sat up two nights together to examine their operations. The first day he observed nothing that deserved remark: but the second

they began to be agitated more than before; the males made a noise somewhat resembling the grunting of a hog; the females only kept sinking and rising in the water.

The male of the first couple ejected the humidity with which his body was swollen, by which the water in the glass was made muddy; and he soon after quitted the female.—Our philosopher continued for twelve hours to observe whether the female would cast her spawn; but finding her tardy, he dissected both her and the male: in the latter, the spermatie vessels were quite empty, as might naturally have been supposed; but for the female, her spawn still remained in her body. Upon its being extracted, and put into the water, it perished without producing any animal whatever. From hence he justly concluded, that it required that the eggs should be ejected from the body of the female before they could be at all prolific. In another pair the male quitted the female, who did not eject her spawn till sixteen days after; and these, like the former, came to nothing. But it was very different with some of the rest. The females ejected their spawn while the male still remained in his station, and impregnated the masses at different intervals as they fell from her; and these all brought forth animals in the usual course of generation. From these observations it was easy to infer, that the female was impregnated neither by the mouth, as some philosophers imagined, nor by the excrescence at the thumbs, as was the opinion of Linnæus, but by the insersion of the male seminal fluid upon the eggs, as they proceeded from the body.

A single female produces from six to eleven hundred eggs at a time; and, in general, she throws them all out together by a single effort; though sometimes she is an hour in performing this task. While she is thus bringing forth, it may be observed that the male acts the part of a midwife, and promotes the expulsion of the eggs by working with his thumbs; and compressing the female's body more closely. The eggs which were compressed in the womb, upon being emitted, expand themselves into a round form, and drop to the bottom of the water; while the male swims off, and strikes with his arms as usual, though they had continued so long in a state of violent contraction.

The egg, or little black globe, which produces a tadpole, is surrounded with two different kinds of liquor. That which immediately surrounds the globe is clear and transparent, and is contained in its proper membrane; that which surrounds the whole is muddy and mucous. The transparent liquor serves for the nourishment of the tadpole from time to time; and answers the same purposes that the white of the egg does to birds. The tadpoles, when this membrane is broken, are found to adhere with their mouth to part of it; and when they get free, they immediately sink to the bottom of the water, never

being able to get to the top after, while they continue in their tadpole form.

But to return—When the spawn is emitted and impregnated by the male, it drops, as was said, to the bottom, and there the white quickly and sensibly increases. The eggs, which, during the four first hours, suffer no perceptible change, begin then to enlarge and grow lighter; by which means they mount to the surface of the water. At the end of eight hours the white in which they swim grows thicker, the eggs lose their blackness, and, as they increase in size, somewhat of their spherical form. The twenty-first day, the egg is seen to open a little on one side, and the beginning of a tail to peep out, which becomes more and more distinct every day. The thirty-ninth day the little animal begins to have motion; it moves at intervals its tail; and it is perceived that the liquor in which it is circumfused serves it for nourishment. In two days more some of these little creatures fall to the bottom; while others remain swimming in the fluid around them, while their vivacity and motion is seen to increase. Those which fall to the bottom remain there the whole day; but having lengthened themselves a little, for hitherto they are doubled up, they mount, at intervals, to the mucus which they had quitted, and are seen to feed upon it with great vivacity. The next day they acquire their tadpole form. In three days more they are perceived to have two little fringes, that serve as fins beneath the head; and these, in four days after, assume a more perfect form. It is then, also, that they are seen to feed very greedily upon the pond-weed with which they are to be supplied; and, leaving their former food, on this they continue to subsist till they arrive at maturity. When they come to be ninety-two days old, two small feet are seen beginning to bourgeon near the tail: and the head appears to be separate from the body. The next day the legs are considerably enlarged: four days after they refuse all vegetable food; their mouth appears furnished with teeth; and their hinder-legs are completely formed. In two days more the arms are completely produced; and now the frog is every way perfect, except that it still continues to carry the tail. In this odd situation the animal, resembling at once both a frog and a lizard, is seen frequently rising to the surface, not to take food, but to breathe. In this state it continues for about six or eight hours, and then, the tail dropping off by degrees, the animal appears in its most perfect form.¹

¹ The tadpole, when it has emerged from the egg, is essentially a fish; it is entirely deficient in members, moving solely by its tail; it breathes by gills like a fish, and all its systems are adapted to this form of structure; its brain and nervous system, its circulating system, and its digestive organs, are all those of a fish. The gills which are first developed hang loosely on the sides of the neck; but afterwards, in the tadpole of the common frog, become enclosed like those of the cartilaginous fishes. As

Thus the frog, in less than a day having changed its figure, is seen to change its appetites also. So extraordinary is this transformation, that the food it fed upon so greedily but a few

the tadpole grows, a remarkable series of changes takes place; the body increases in size whilst the tail remains stationary; the legs are put forth, the hind pair appearing first; the gills are no longer employed, but are superseded by the lungs; the tail becomes rudimentary; the gills disappear; and the animal quits the water, having become a frog, breathing air, and depending for locomotion on its extremities alone. Some of the class, however, continue aquatic; but these do not breathe by gills, but take air into their lungs at the surface of the water. There is a period in the development of the tadpole, in which there is a kind of balancing between the organs which are disappearing, and those which are becoming developed; when the gills and lungs exist simultaneously, and the legs as well as the tail are employed for progression. This state is transitory in the common tadpole, and only exists for a short time; but in some other animals of the class it remains permanent—their development being, as it were, stopped short, since they never assume the complete reptile form, but retain their gills along with imperfect lungs, and their tail with imperfect extremities, and are able to breathe either air or water. Of this kind of animals (which are termed *Perennibranchiate* in contradistinction to the frog and others, which are *Caducibranchiate*) are the proteus, which being found in the underground passages between the lakes in Carniola and Styria, was long supposed to be the imperfect larva of some reptile; and the siren, which exists in Virginia, besides several others.

The metamorphosis of tadpoles, like that of insects, is a most interesting subject of investigation to the philosophic naturalist, since it affords him an evident instance of the change which takes place in all animals during the progress of their development. The embryo of man, for instance, differs even more from his perfect condition, than the tadpole from the frog. Each organ and system in all the higher animals passes, during the progress of their development, through a series of forms corresponding to those which remain permanent in the lower parts of the scale. Thus the brain of a man passes through the successive forms which are characteristic of the fish, the reptile, the bird, the lower mammalia, and the higher mammalia; the heart undergoes a similar series of transformations, appearing at first like the simple pulsating vessel of the Amelides, gradually acquiring a regular cavity surrounded by muscular fibres like that of the crustacea, another being afterwards added, as in the fish, a third as in the reptiles, and at last the four complete cavities being separated, which characterize the heart formed for a perfect double circulation. The great difference between the metamorphosis of the human embryo, and that of the insect or frog, consists in this,—that, in the former case, the development of each organ goes on without reference to the corresponding state of the others. As the life of the being is maintained by its parent, it is not necessary that there should be that harmony between the corresponding states of the different organs which is essential in a being which is to maintain an independent existence. In the larva of the insect, or the tadpole of the frog, however, there is that harmony; each of them belongs to a class lower than that of its adult form, because its whole organization assumes, for the time, the characters of that class; it does not receive sufficient nutriment from its parent, stored up in the egg, to enable it to come to its full develop-

days before, is now utterly rejected; it would even starve if supplied with no other. As soon as the animal acquires its perfect state, from having fed upon vegetables, it becomes carnivorous, and lives entirely upon worms and insects. But as the water cannot supply these, it is obliged to quit its native element, and seek for food upon land, where it lives by hunting worms, and taking insects by surprise. At first, being feeble and unable to bear the warmth of the sun, it hides among bushes and under stones; but when a shower comes to refresh the earth, then the whole multitude are seen to quit their retreats, in order to enjoy the grateful humidity. Upon many occasions the ground is seen perfectly blackened with their numbers; some hunting for prey, and some seeking secure lurking-places. From the myriads that offer on such occasions, some have been induced to think that these animals were generated in the clouds, and thus showered down on the earth. But had they, like Derham, traced them to the next pool, they would have found out a better solution for the difficulty.

The frog lives for the most part out of the water; but when the cold nights begin to set in, it returns to its native element, always choosing stagnant waters, where it can lie without danger concealed at the bottom. In this manner it continues torpid, or with but very little motion, all the winter: like the rest of the dormant race, it requires no food; and the circulation is slowly carried on without any assistance from the air.

It is at the approach of spring that all these animals are roused from a state of slumber to a state of enjoyment. A short time after they rise from the bottom they begin to pair, while those that are as yet too young come upon land before the rest. For this reason, while the old ones continue concealed in the beginning of spring, the small ones are more frequently seen; the former remaining in the lake to propagate, while the latter are not yet arrived at a state of maturity.

The difference of sexes, which was mentioned above, is not perceivable in these animals until they have arrived at their fourth year; nor do they begin to propagate till they have completed that period. By comparing their slow growth with their other habits, it would appear that they live about twelve years; but having so ment, before quitting the shell; it comes forth, therefore, in a state which, as regards its ultimate condition, is imperfect; but which enables it to maintain its own existence, by procuring and assimilating its own food.

The tadpoles are omnivorous; and the immense multitude of them assist in preventing the stagnation of the pools, by devouring decaying animal or vegetable matter; and they afford, at the same time, support to ducks and other frequenters of marshy places. As summer advances, and the ponds are dried up, the tadpoles are sufficiently advanced to quit the water, and then feed principally on worms and insects.—*Dr. Carpenter.*

many enemies, both by land and water, it is probable that few of them arrive at the end of their term.

Frogs live upon insects of all kinds; but they never eat any unless they have motion. They continue fixed and immoveable till their prey appears; and just when it comes sufficiently near, they jump forward with great agility, dart out their tongues, and seize it with certainty. The tongue, in this animal, as in the toad, lizard, and serpent kinds, is extremely long, and formed in such a manner, that it swallows the point down its throat; so that a length of tongue is thus drawn out, like a sword from its scabbard, to assail its prey. This tongue is furnished with a glutinous substance; and whatever insect it touches, infallibly adheres, and is thus held fast till it is drawn into the mouth.

As the frog is thus supplied with the power of catching its prey, it is also very vivacious, and able to bear hunger for a very long time. I have known one of them continue a month in summer without any other food than the turf on which it was placed in a glass vessel. We are told of a German surgeon, that kept one eight years in a glass vessel, covered with a net. Its food was at all times but sparing: in summer he gave it fresh grass, which it is said to have fed upon; and, in the winter, hay, a little moistened; he likewise, now and then, put flies into the glass, which it would follow with an open mouth, and was very expert in catching them. In winter, when the flies were difficult to be found, it usually fell away, and grew very lean; but in the summer, when they were plenty, it soon grew fat again. It was kept in a warm room, and was always lively and ready to take its prey: however, in the eighth winter, when there were no flies to be found, it fell away and died. It is not certain how long it might have lived, had it been supplied with proper nourishment; but we are certain, that a very little food is capable of sufficing its necessities.

Nor is the frog less tenacious of life. It will live and jump about several hours after its head has been cut off. It will continue active, though all its bowels are taken out; and it can live some days, though entirely stripped of its skin. This cruel trick, which is chiefly practised among school-boys, of skinning frogs, an operation which is done in an instant, seems for some hours no way to abate their vigour. I am assured that some of them get a new skin, and recover, after this painful experiment.

The croaking of frogs is well-known; and, from thence, in some countries, they are distinguished by the ludicrous title of Dutch nightingales.²

² Mr. Churchill, in his 'Memorials of Missionary Life in Nova Scotia' [London 1845], says, "The singing of birds reminds us of another transatlantic peculiarity, the music of the frogs. The term itself may perhaps provoke a smile, but still the frogs are worthy of the provincial designation they have ob-

Indeed, the aquatic frogs of Holland are loud beyond what one would imagine. We could hardly conceive that an animal, no bigger than one's fist, should be able to send forth a note that is heard at three miles' distance; yet such is actually the case.³ The large water-frogs have a note as loud as the bellowing of a bull; and, for this purpose, puff up the cheeks to a surprising magnitude. Of all frogs, however, the male only croaks; the female is silent, and the voice in the other seems to be the call to courtship. It is certain, that at these times when they couple, the loudness of their croaking is in some places very troublesome: for then the whole lake seems vocal; and a thousand dissonant notes perfectly stun the neighbourhood. At other times also, before wet weather, their voices are in full exertion: they are then heard with unceasing assiduity, sending forth their call, and welcoming the approach of their favourite moisture. No weather-glass was ever so true in foretelling an approaching change; and, in fact, the German surgeon, mentioned above, kept his frog for that purpose. It was always heard to croak at the approach of wet weather; but was as mute as a fish when it threatened a continuance of fair. This may probably serve to explain an opinion which some entertain, that there is a month in the year called *Paddock Moon*, in which the frogs never croak: the whole seems to be no more than that, in the hot season, when the moisture is dried away, and consequently, when these animals neither enjoy the quantity of health nor food that at other times they are supplied with, they show, by their silence, how much they are displeased with the weather. All very dry weather is hurtful to their health, and prevents them from getting their prey. They subsist chiefly upon worms and snails; and as drought prevents these from appearing, the frog is thus stinted in its provisions, and also wants that

tained, they are the nightingales of Nova Scotia. I have heard them with all the variety of sounds, and the succession of cadences, so remarkable in the music of the Æolian harp—nor is there any thing overdrawn in this simile—the softness of the flageolet, and the shrillness and clearness of a whistle, might both be adduced as illustrations; but no language can convey a correct idea. Sometimes on approaching the swamp where the concert is held, if in a wheeled vehicle, when the noise of the wheels is heard, a chirp or two like the note of a bird is heard, and this operates as an alarm—in a moment all is still. Then if the auditor will stay his progress and listen, he will be amply repaid—one single note, with a vibration in the sound, similar to that which would be produced by putting a small pea into a flageolet, will be heard, low in tone, but distinct and musical; in a second or two this will be followed by a higher note, perfectly according in harmony, then another and another, until you have successively solo, duet, trio, quartette, and full chorus: the deep hoarse note of the bull frog occasionally heard like the sound produced by twanging with the finger the thick string of the violoncello.—*ED.*

³ Kæsel, *ibid.*

grateful humidity which moistens its skin, and renders it alert and active.

As frogs adhere closely to the backs of their own species, so it has been found, by repeated experience, they will also adhere to the backs of fishes. Few that have ponds, but know that these animals will stick to the backs of carp, and fix their fingers in the corner of each eye. In this manner they are often caught together; the carp blinded and wasted away. Whether this proceeds from the desires of the frog, disappointed of its proper mate, or whether it be a natural enmity between frogs and fishes, I will not take upon me to say. A story told us by Walton might be apt to incline us to the latter opinion.

"As Dubravius, a bishop of Bohemia, was walking with a friend by a large pond in that country, they saw a frog, when a pike lay very sleepily and quiet by the shore side, leap upon his head, and the frog having expressed malice or anger by his swollen cheeks and staring eyes, did stretch out his legs, and embraced the pike's head, and presently reached them to his eyes, tearing with them and his teeth those tender parts; the pike, irritated with anguish, moves up and down the water, and rubs himself against weeds, and whatever he thought might quit him of his enemy; but all in vain, for the frog did continue to ride triumphantly, and to bite and torment the pike till his strength failed, and then the frog sunk with the pike to the bottom of the water: then presently the frog appeared again at the top, and croaked, and seemed to rejoice like a conqueror; after which he presently retired to his secret hole. The bishop, that had beheld the battle, called his fisherman to fetch his nets, and by all means to get the pike, that they might declare what had happened. The pike was drawn forth, and both his eyes eaten out; at which, when they began to wonder, the fisherman wished them to forbear, and assured them he was certain that pikes were often so served."

SUPPLEMENTARY NOTE.

There are various species of frogs, of which we notice the more remarkable.

The Common frog of this country is called the *Red frog* by the French. The *Green frog* is the common frog of France, and is the one chiefly used at table. Its thighs are in great request there among the amateurs of good cheer, although in this country a stupid prejudice exists against it. Its colour is an olive green, distinctly marked with black patches on the back, and on the limbs with transverse bars of the same. From the tip of the nose three distinct stripes of a pale yellow extend to the extremity of the body, the middle one slightly depressed, and the lateral ones considerably elevated. The under parts are of a pale whitish colour tinged with green, and marked with irregular brown spots. Though not common in England, it is found in great plenty in Italy, France, and Germany. This species seldom deposits its spawn before the month of June. During this season the male is said to croak so loud as to be heard at a great distance. In some particular places,

where these animals are numerous, their croaking is very oppressive to persons unaccustomed to it. The globules of spawn are smaller than those of the common frog; and the young are considerably longer in attaining their complete state, this seldom taking place till November. They arrive at their full growth in about four years, and live to the age of sixteen or seventeen. They are excessively voracious, frequently seizing young birds, and even mice, which, like the rest of their prey of snails, worms, &c., they swallow whole. "These frogs," says a correspondent of the *Gardener's Chronicle*, "are used on the continent as barometers. The first I ever saw was in a shop at Munich. On inquiring of the owner, he informed me that he had had it for several years. It was kept in a tall (confectioner's) glass about a foot high, with a piece of coarse gauze or muslin tied over the top; at the bottom was some wet moss, sufficiently deep for the little creature to hide itself in; this was changed every week or fortnight. It was very fond of flies; but these, the man said, he gave it occasionally more as a *bonne bouche* than as a matter of food. A little wooden ladder reached from the bottom to within an inch of the top. As the weather changed, so did froggy ascend or descend, and if it was to set fair he would sometimes sit for days on the top step; whilst, if bad weather came, he would also for days hide himself in the wet moss. I afterwards mentioned the circumstance to the late Mr. Douce; he expressed a strong desire for one, which, with some difficulty, I procured on my next visit to the continent. This lived with me for many weeks; I had a basket made into which the glass dropped, and which I suspended in the carriage. I am quite sure at last the little creature knew me: its eyes would sparkle when I came up to it; if I gave it a fly, it would suffer the insect to buzz about for perhaps a minute, then make a sudden dart, and swallow it at a mouthful. Unfortunately, Mr. Douce placed it in a glass nearly filled with water, and it died soon after he had it. I have never since been able to procure another. They are extremely interesting, and in an elegant-shaped glass would form a most beautiful and useful ornament in any drawing-room as a barometer."

Edible frogs are brought from the country, thirty or forty thousand at a time, to Vienna, and sold to the great dealers, who have conservatories for them, which are large holes, four or five feet deep, dug in the ground, the mouth covered with a board, and in severe weather with straw. In these conservatories, even during a hard frost, the frogs never become quite torpid; when taken out, and placed on their backs, they are always sensible of the change, and have strength enough to turn themselves. They get together in heaps, one upon another, instinctively, and thereby prevent the evaporation of their humidity; for no water is ever put to them. In Vienna, in the year 1793, there were only three great dealers, by whom most of those persons were supplied who brought them to the market ready for the cook. As their spawning time is so very late in the year, those animals that are brought to market before the month of June for edible frogs, are supposed to be either common frogs, or sometimes toads.

Mr. Meredeth thus describes the green frog of Australia: "In the Macquaria, near Bathurst, I first saw the superb green frogs of Australia. The river, at the period of our visit, was for the most part a dry bed, with small pools in the deeper holes, and in these among the few shining water-plants and *confervæ*, dwelt these gorgeous reptiles. In form and size they resemble a very large English frog, but their colour is more beautiful than words can describe. I never saw plant or gem of such bright tints. A vivid yellow green seems the groundwork of the creature's array; and this is daintily pencilled

over with other shades—emerald-olive and blue-green, and a few delicate markings of yellow, like an embroidery of gold thread upon shaded velvet. As the creatures sit looking at you from their moist floating bowers, with their large eyes expressive of the most perfect enjoyment, which, if you doubt while they remain still, you can't refuse to believe in when you see them float into the delicious cool water, and go slowly stretching their long green legs, as they pass through the wavy grove of feathery plants in the river's bed, till you lose them under a dense mass of gently-waving leaves. And to see this while a burning, broiling sun is scorching up your very life, and not a breath is stirring, and the glare of the herbless earth dazzles your agonizing eyes into blindness, is enough to make one willing to forego all the glories of humanity, and be changed into a frog!"

The large water, or *Bull-frog*, is also edible, having as much on them as a young fowl. It frequently measures from the nose to the hind feet, a foot and a half, or upwards. Its colour is a dusky olive brown, marked with numerous dark spots, lighter beneath than above. The external membranes of the ears are large, round, and of a brownish red surrounded by a yellowish margin. This species is chiefly found in the interior parts of America, where, at the springs and small rills, they are said to sit in pairs. Kalm, however, says, that they frequent only ponds and marshes. In Virginia they are in such abundance, that there is scarcely a single spring that has not a pair of them. The inhabitants, who respect them as genii of the fountains, imagine that they purify the water. The women, however, are no friends to them, because they kill and eat young ducks and goslings; and sometimes they carry off chickens that venture too near the pond. When suddenly surprised, by a long leap or two they enter their hole, at the bottom of which they lie perfectly secure. A full-grown bull-frog will sometimes leap three yards. Kalm relates the following story respecting one of them. The American Indians are known to be excellent runners, being almost able to equal the best horse in its swiftest course. In order, therefore, to try how well the bull-frog could leap, some Swedes laid a wager with a young Indian that he could not overtake one of them, provided it had two leaps beforehand. They carried a bull-frog, which they had caught in a pond, into a field, and burnt its tail. The fire, and the Indian who endeavoured to get up to the frog, had together such an effect on the animal, that it made its long leaps across the field as fast as it could. The Indian pursued it with his might. The noise he made in running frightened the poor frog; probably it was afraid of being tortured with fire again, and therefore it redoubled its leaps, and by that means reached the pond, which was fixed on as their goal, before the Indian could overtake it. This animal is called the bull-frog on account of its croaking, which is said somewhat to resemble the hoarse lowing of a bull; and when, in a calm night, many of them are making a noise together, they may be heard to the distance of a mile and a half. The night is the time when they croak, and they are said to do it at intervals. In this act they are either hidden among the grass or rushes, or they are in the water, with their heads above the surface. Kalm informs us that, as he was one day riding out, he heard one of them roaring before him, and supposed it to be a bull hidden in the bushes at a little distance. The voice was, indeed, more hoarse than that of a bull, yet it was too loud for him to conceive that it could be emitted by so small an animal as a frog, and he was in considerable alarm for his safety. He was undeceived a few hours afterwards, by a party of Swedes, to whom he had communicated his fears.

The *Tree-frog*, which is a native of America, France, Germany, Italy, and many other European regions, but never found in Britain, is small, and of a slender and very elegant shape. It is the only species found in Europe of a genus called *Hyla*, which are distinguished from frogs and toads by the viscous cushions by which the toes are terminated. Its upper parts are green, and the abdomen is whitish, marked by numerous granules. The under surface of the limbs is reddish, and on each side of the body there is a longitudinal blackish or violet-coloured streak. The body is smooth above, and the hind-legs are very long and slender. At the end of each toe is a round, fleshy, concave apparatus, not unlike the mouth of a leech, by means of which the animal is enabled to adhere even to the most polished surfaces. This animal, during the summer-months, resides principally on the upper branches of the trees, where it wanders among the foliage in quest of insects. These it catches with great dexterity, stealing softly to them, as a cat does to a mouse, till at a proper distance, when it makes a sudden spring upon them of frequently more than a foot in height. It often suspends itself by its feet or abdomen, to the upper parts of leaves, remaining thus concealed among the foliage. The skin of the abdomen is covered with small glandular granules of such a nature as to allow the animal to adhere as well by these as by the toes. It will even stick to glass by pressing its belly against it. About the end of autumn the *tree-frog* retires to the water and lies concealed in a torpid state in the mud till the spring, when, on the return of warm weather, it emerges, like the rest of the genus, to deposit its spawn in the water. At this period the male inflates his throat in a surprising manner, forming a large sphere beneath his head; he also exerts a very loud and sharp croak, that may be heard to a vast distance. The tadpoles become perfected about the beginning of August, and they soon afterwards begin to ascend the adjacent trees. At this time they are particularly noisy in the evenings on the approach of rain; therefore, if kept in glasses in a room, and supplied with proper food, they will supply the place of barometers by affording sure presage of changes of weather.

Tree-frogs have been kept also by Dr. Townson, who had them in a window, and appropriated to their use a bowl of water, in which they lived. They soon grew quite tame; and to two that he had had for a considerable length of time, and were particular favourites, the doctor gave the names of Damon and Musidora. In the evening they seldom failed to go into the water, unless the weather was cold and damp, in which case they would sometimes stay out a couple of days. When they were out of the water, if a few drops were thrown upon the board, they always applied their bodies as close to it as they could; and from this absorption through the skin, though they were flaccid before, they soon again appeared plump. A *tree-frog* that had not been in the water during the night was weighed, and then immersed; after it had remained half an hour in the bowl it came out, and was found to have absorbed nearly half its own weight of water. From other experiments, it was discovered that these animals frequently absorbed nearly their whole weight of water; and that, as was clearly proved, by the under surface only of the body. They will even absorb water from wetted blotting-paper. Sometimes they eject water with considerable force from their bodies, to the quantity of a fourth part or more of their weight. Before the flies had disappeared in autumn, the doctor had collected for his favourite *tree-frog*, Musidora, a great quantity, as winter-provision. When he laid any of them before her she took no notice of them, but the moment he moved them with his breath, she sprang upon and ate them. Once, when

flies were scarce, the doctor cut some flesh of a tortoise into small pieces, and moved them by the same means; she seized them, but the instant afterwards rejected them from her tongue. After he had obtained her confidence, she ate from his fingers dead as well as living flies. Frogs will leap at the moving of any small object; and, like toads, they will also soon become sufficiently familiar to sit on the hand, and be carried from one side of a room to the other, to catch flies as they settle on the wall. This gentleman accordingly made them his guards at Göttingen, for keeping these troublesome creatures from his dessert of fruit, and they performed their task highly to his satisfaction. He has seen the small *tree-frogs* eat humble-bees, but this was never done without some contest: they are in general obliged to reject them, being incommoded by their stings and hairy roughness; but in each attempt the bee is further covered with the viscid matter from the frog's tongue, and when thus coated it is swallowed with facility.

A battle between a *tree-frog* and snake was seen in the top of a mangrove-tree, by one of the officers who was with Captain Stedman, when he was sailing up one of the rivers of Surinam in a canoe. When the captain first perceived them, the head and shoulders of the frog were in the jaws of the snake, which was about the size of a large kitchen poker. This creature had its tail twisted round a tough limb of the mangrove, while the frog, which appeared about the size of a man's fist, had laid hold of a twig with its hind-feet. In this position they were contending, the one for life, the other for his dinner, forming one straight line between the two branches; and thus they continued for some time, apparently stationary, and without a struggle. Still it was hoped that the poor frog might extricate himself by his exertions, but the reverse was the case. The jaws of the snake gradually relaxing, and by their elasticity forming an incredible orifice, the body and fore-legs of the frog by little and little disappeared, till finally nothing more was seen than the hinder-feet and claws, which were at last disengaged from the twig, and its formidable adversary drew it down its throat by suction. The frog passed some inches farther down the alimentary canal, and at last stuck, forming a knob or knot at least six times as thick as the snake, whose jaws and throat immediately contracted, and resumed their former natural shape.

The *Fire-frog* is the least of all the European frogs, hardly ever equalling the *tree-frog* in size, and is a native of Germany, Italy, and many other parts of Europe, but is not found in England. Its colour on the upper part is of a dull olive-brown, the skin being marked with large and small tubercles; round the edges of the mouth is placed a row of blackish streaks or perpendicular spots. The under parts both of the body and limbs are orange-coloured, spotted or variegated with irregular markings of dull blue. It is from the colour of the under surface of its body that this species has obtained the name of *fire-frog*.

Mr. Owen has discovered that some fragments of bones, found in the new red sandstone, and hitherto supposed to be the remains of Saurians, must have belonged to an animal of this group; the microscopic structure of its teeth being essentially the same. The size of this giant-frog must have been at least that of a good-sized pig; and there is reason to believe that it was the animal which made the remarkable impressions on the sandstone of the Stourton quarries, which have excited so much speculation amongst geologists.

CHAP. III.

OF THE TOAD, AND ITS VARIETIES.

IF we regard the figure of the toad, there seems nothing in it that should disgust more than that of the frog. Its form and proportions are nearly the same; and it chiefly differs in colour, which is blacker; and its slow and heavy motion, which exhibits nothing of the agility of the frog: yet such is the force of habit, begun in early prejudice, that those who consider the one as a harmless playful animal, turn from the other with horror and disgust. The frog is considered as a useful assistant, in ridding our grounds of vermin; the toad, as a secret enemy, that only wants an opportunity to infect us with its venom.

The imagination, in this manner biassed by its terrors, paints out the toad in the most hideous colouring, and clothes it in more than natural deformity. Its body is broad; its back flat; covered with a dusky pimpled hide; the belly is large and swagging; the pace laboured and crawling; its retreat gloomy and filthy; and its whole appearance calculated to excite disgust and horror: yet, upon my first seeing a toad, none of all these deformities in the least affected me with sensations of loathing: born, as I was, in a country where there are no toads, I had prepared my imagination for some dreadful object; but there seemed nothing to me more alarming in the sight, than in that of a common frog; and, indeed, for some time, I mistook, and handled the one for the other. When first informed of my mistake, I very well remember my sensations: I wondered how I had escaped with safety, after handling and dissecting a toad, which I had mistaken for a frog. I then began to lay in a fund of horror against the whole tribe, which, though convinced they are harmless, I shall never get rid of. My first imaginations were too strong not only for my reason, but for the conviction of my senses.

As the toad bears a general resemblance of figure to the frog, so also it resembles that animal in its nature and appetites. Like the frog, the toad is amphibious; like that animal, it lives upon worms and insects, which it seizes by darting out its length of tongue; and in the same manner also it crawls about in moist weather. The male and female couple as in all the frog kind; their time of propagation being very early in the spring. Sometimes the females are seen upon land oppressed by the males; but more frequently they are coupled in the water. They continue together some hours, and adhere so fast as to tear the very skin from the parts they stick to. In all this they resemble the frog; but the assistance which the male lends the female, in bringing forth, is a peculiarity in this species that must not be passed over in silence. "In the evening of a summer's day, a French gentleman,

being in the king's gardens at Paris, perceived two toads coupled together, and he stopped to examine them. Two facts equally new surprised him; the first was the extreme difficulty the female had in laying her eggs; the second was the assistance lent her by the male for this purpose. The eggs of the female lie in her body, like beads on a string; and after the first, by great effort, was excluded, the male caught it with his hinder paws, and kept working it till he had thus extracted the whole chain. In this manner the animal performed, in some measure, the functions of a midwife; impregnating, at the same time, every egg as it issued from the body."

It is probable, however, that this difficulty in bringing forth obtains only upon land; and that the toad, which produces its spawn in the water, performs it with as much ease as a frog. They propagate in England exactly in the manner of frogs; and the female, instead of retiring to dry holes, goes to the bottom of ponds, and there lies torpid all the winter, preparing to propagate in the beginning of spring. On these occasions, the number of males is found greatly to surpass that of the other sex, there being above thirty to one; and twelve or fourteen are often seen clinging to the same female.

When, like the frog, they have undergone all the variations of their tadpole state, they forsake the water; and are often seen, in a moist summer's evening, crawling up, by myriads, from fenny places, into dryer situations. There, having found out a retreat, or having dug themselves one with their mouth and hands, they lead a patient solitary life, seldom venturing out, except when the moisture of a summer's evening invites them abroad. At that time the grass is filled with snails, and the pathways covered with worms which make their principal food. Insects also of every kind they are fond of; and we have the authority of Linnæus for it, that they sometimes continue immoveable, with the mouth open, at the bottom of shrubs, where the butterflies, in some measure fascinated, are seen to fly down their throats.¹

In a letter from Mr. Arscott, there are some curious particulars relating to this animal, which throws great light upon its history. "Concerning the toad," says he, "that lived so many years with us, and was so great a favourite, the greatest curiosity was its becoming so remarkably tame; it had frequented some steps before our hall-door some years before my acquaintance commenced with it, and had been admired by my father for its size, (being the largest I ever met with,) who constantly paid it a visit every evening. I knew it myself above thirty years; and by constantly feeding it, brought it to be so tame, that it always came to the candle, and looked up, as if expecting to be taken up and brought upon the table, where I always fed it with insects of all sorts.

¹ Amœnit. vol. vi. p. 201.

It was fondest of flesh maggots, which I kept in bran; it would follow them, and when within a proper distance, would fix his eyes, and remain motionless for near a quarter of a minute, as if preparing for the stroke, which was an instantaneous throwing its tongue at a great distance upon the insect, which stuck to the tip by a glutinous matter. The motion is quicker than the eye can follow. I cannot say how long my father had been acquainted with the toad, before I knew it; but when I was first acquainted with it, he used to mention it as the old toad I have known so many years; I can answer for thirty-six years. This old toad made its appearance as soon as the warm weather came; and I always concluded it retired to some dry bank, to repose till spring. When we new layed the steps, I had two holes made in the third step, on each, with a hollow of more than a yard long for it; in which I imagine it slept, as it came from thence at its first appearance. It was seldom provoked. Neither that toad, nor the multitudes I have seen tormented with great cruelty, ever showed the least desire of revenge, by spitting or emitting any juice from their pimples. Sometimes, upon taking it up, it would let out a great quantity of clear water, which, as I have often seen it do the same upon the steps when quite quiet, was certainly its urine, and no more than a natural evacuation. Spiders, millipedes, and flesh maggots, seem to be this animal's favourite food. I imagine if a bee was to be put before a toad, it would certainly eat it to its cost;² but as bees are seldom stirring at the same time that toads are, they rarely come in their way; as they do not appear after sun-rising, or before sun-set. In the heat of the day they will come to the mouth of their hole, I believe for air. I once, from my parlour window, observed a large toad I had in the bank of a bowling green, about twelve at noon in a very hot day, very busy and active upon the grass. So uncommon an appearance made me go out to see what it was; when I found an innumerable swarm of winged ants had dropped round his hole; which temptation was as irresistible as a turtle would be to a luxurious alderman. In respect to its end, had it not been for a tame raven, I make no doubt but it would have been now living. This bird, one day seeing it at the mouth of its hole, pulled it out, and, although I rescued it, pulled out one eye, and hurt it so, that notwithstanding its living a twelvemonth, it never enjoyed itself, and had a difficulty of taking its food, missing the mark for want of its eye. Before that accident, it had all the appearance of perfect health."

To this account of the toad's inoffensive qualities, I will add another from Valisnieri, to show that, even taken internally, the toad is no way dangerous. "In the year 1692, some German

² Ræsel tried a frog; it swallowed the bee alive: its stomach was stung, and the animal vomited it up again.

soldiers, who had taken possession of the castle of Arceti, finding that the peasants of the country often amused themselves in catching frogs, and dressing them for the table; resolved to provide themselves with a like entertainment, and made preparations for frog-fishing, in the same manner. It may easily be supposed that the Italians and their German guests were not very fond of each other; and indeed it is natural to think that the soldiers gave the poor people of the country many good reasons for discontent. They were not a little pleased, therefore, when they saw them go to a ditch where toads, instead of frogs, were found in abundance. The Germans, no way distinguishing in their sport, caught them in great numbers; while the peasants kept looking on, silently flattering themselves with the hopes of speedy revenge. After being brought home, the toads were dressed up after the Italian fashion: the peasants quite happy at seeing their tyrants devour them with so good an appetite, and expecting every moment to see them drop down dead. But what was their surprise to find that the Germans continued as well as ever, and only complained of a slight excoriation of the lips, which, probably, arose from some other cause than that of their repast."

I will add another story, from Solenander; who tells us, that a tradesman of Rome and his wife had long lived together with mutual discontent; the man was dropsical, and the woman amorous: this ill-matched society promised soon, by the very infirm state of the man, to have an end; but the woman was unwilling to wait the progress of the disorder; and therefore concluded that, to get rid of her husband, nothing was left her but poison. For this purpose she chose out a dose that she supposed would be the most effectual; and having calcined some toads, mixed their powder with his drink. The man, after taking a hearty dose, found no considerable inconvenience, except that it greatly promoted urine. His wife, who considered this as a beginning symptom of the venom, resolved not to stint the next dose, but gave it in greater quantities than before. This also increased the former symptom; and, in a few days, the woman had the mortification to see her detested husband restored to perfect health, and remained in utter despair of ever being a widow.

From all this it will appear with what injustice this animal has hitherto been treated. It has undergone every kind of reproach; and mankind have been taught to consider, as an enemy, a creature that destroys that insect-tribe which are their real invaders.³ We are to treat, there-

³ The common toad, which is generally esteemed the most loathsome of British reptiles, and which boys too often heedlessly pelt with stones, as if it were a creature injurious to mankind, is an animal of considerable use in the economy of nature, being evidently created for the purpose of destroying and clearing away worms and other small vermin which

fore, as fables, those accounts that represent the toad as possessed of poison to kill at a distance; of its ejecting its venom, which burns wherever it touches; of its infecting those vegetables near

would injure vegetation. The character of this inoffensive creature has been well described by Mr. Fothergill, a naturalist. "The common food of the toad," says he, "is small worms, and insects of every description; but its favourite food consists of bees and wasps. When a toad strikes any of these insects, however, deglutition does not immediately take place, as in other cases, but the mandibles remain closely compressed for a few seconds, in which time the bee or wasp is killed, and all danger of being stung avoided. The mandibles are provided with two protuberances, which appear to be destined for this office. Although capable of sustaining long abstinence, the toad is a voracious feeder when opportunity offers. To a middle-sized one the writer has given nine wasps, one immediately after another; the tenth it refused, but in the afternoon of the same day it took eight more. To see the toad display its full energy of character, it is necessary to discover it in its place of retirement for the day, and, if possible, unperceived, to drop an insect within its sight; it immediately arouses from its apparent torpor, its beautiful eyes sparkle, it moves with alacrity to its prey, and assumes a degree of animation incompatible with its general sluggish appearance. When arrived at a proper distance, it makes a full stop, and, in the attitude of a pointer, motionless eyes its destined victim for a few seconds, when it darts out its tongue upon it, and lodges it in its throat with a velocity which the eye can scarcely follow. It sometimes happens to make an ineffectual stroke, and stuns the insect without gorging it, but never makes a second stroke until the insect resumes motion. It uniformly refuses to feed on dead insects, however recent. For several years a toad took up its abode, during the summer season, under an inverted garden-pot, which had a part of its rim broken out, in the writer's garden, making its first appearance in the latter end of May, and retreating about the middle of September. This toad, there is reason to believe, distinguished the persons of the family, who daily fed it, from strangers, as it would permit them to pat and stroke it. To try the indiscriminating appetite of these animals, the writer has dropped before a full-grown toad a young one of its own species, about three-fourths of an inch long, and the instant it began to move off, it was eagerly struck at and swallowed; but the writer, in repeating this experiment, found that more will refuse than devour the young of their own species. When living minnows were dropped before a toad, they were struck at and swallowed in the same manner. These experiments were made on toads at full liberty, and met with like results."

The useful qualities of this long-persecuted and helpless creature are becoming appreciated by gardeners. A correspondent of 'the Gardeners' Gazette' thus writes:—"C. requests information relative to the destruction of woodlice. I beg to say that we have been subject to the same sort of annoyance which your correspondent complains of. I, too, grow cucumbers in pots, in the front of our pines. Early last spring I was vexed to see some of our choicest sorts nibbled round their stems by those little pests. I resolved on their annihilation, if possible. We removed the pines from the bed, and prepared a tub of salt brine; we forked over the tan lightly; and as we proceeded, others followed with the brine, poured with the rose water pots, thus giving the whole surface a good watering. In this way we had the tan turned and returned several times, by which we quickly destroyed tens of thousands. As auxiliary

which it resides; of its excessive fondness for sage, which it renders poisonous by its approach; these, and a hundred others of the same kind, probably took their rise from an antipathy which some have to all animals of the kind. It is a harmless, defenceless creature, torpid and unvenomous, and seeking the darkest retreats, not from the malignity of its nature, but the multitude of its enemies.

Like all of the frog kind, the toad is torpid in winter. It chooses then, for a retreat, either the hollow root of a tree, the cleft of a rock, or sometimes the bottom of a pond, where it is found in a state of seeming insensibility. As it is very long-lived, it is very difficult to be killed; its skin is tough, and cannot be easily pierced; and, though covered with wounds, the animal continues to show signs of life, and every part appears in motion. But what shall we say to its living for centuries lodged in the bosom of a rock, or cased within the body of an oak-tree, without the smallest access on any side either for nourishment or air, and yet taken out alive and perfect! Stories of this kind it would be as rash to contradict as difficult to believe; we have the highest authorities bearing witness to their truth, and yet the whole analogy of nature seems to arraign them of falsehood. Bacon asserts that toads are found in this manner; Dr. Plot asserts the same. There is, to this day, a marble chimney-piece, at Chatsworth, with the print of a toad upon it, and a tradition of the manner in which it was found. In the Memoirs of the Academy of Sciences there is an account of a toad found alive and healthy in the heart of a very thick elm, without the smallest entrance or egress.⁴ In the year 1731, there was another found, near Nantes, in the heart of an old oak, without the smallest issue to its cell; and the discoverer was of opinion, from the size of the tree, that the animal could not have been confined there less than eighty or a hundred years, without sustenance and without air. To all these we can only oppose the strangeness of the facts; the necessity this animal appears under of receiving air; and its dying, like all other animals,

to our endeavours, we introduced about twenty toads into the house, since which time they have done their duty so vigilantly that we have not been in the least annoyed; and we continued to cut fine fruit from the same plants until October. Perhaps we have a hundred toads in our frames and houses; some of them grown of a large size, which permit us to sleek them without seeming the least alarmed. In the day-time they retire to a flower-pot laid on its side, or some shelter. When we come into the houses in the night we find them busy in their nocturnal rounds, and the hapless woodlice or beetles which come in their way find a quick exit into another state. Our men used formerly to think it meritorious to destroy them as something accursed. Now, when they find a fine toad, they bring it into the garden as something worthy of a moment's consideration in the grand scale of animated nature."—*Ed.*

⁴ Vide the year 1719.

in the air-pump, when deprived of this all-sustaining fluid. But whether these be objections to weigh against such respectable and disinterested authority I will not pretend to determine; certain it is that if kept in a damp place, the toad will live for several months without any food whatsoever.⁵

To this extraordinary account, which is doubtful, I will add another not less so; which is, that of toads sucking cancerous breasts, and thus extracting the venom, and performing a cure. The first account we have of this is in a letter to the bishop of Carlisle from Dr. Pitfield, who was the first person of consequence that attended the experiment. His letter is as follows:—

“Your lordship must have taken notice of a paragraph in the papers with regard to the application of toads to a cancered breast. A patient of mine has sent to the neighbourhood of Hungerford, and brought down the very woman on whom the cure was done. I have, with all the attention I am capable of, attended the operation for eighteen or twenty days, and am surprised at the phenomenon. I am in no expectation of any great service from the application; the age, constitution, and thoroughly cancerous condition, of the person, being unconquerable barriers to it. How an ailment of that kind, absolutely local, in an otherwise sound habit, and of a likely age, might be relieved, I cannot say. But as to

⁵ In 1777, Herissant undertook some experiments to ascertain the truth of facts of this kind, which might appear fabulous. He shut up three toads in sealed boxes in plaster, and they were deposited in the Academy of Sciences. At the end of eighteen months one of these toads was dead, but the other two were still living. Nobody could doubt the authenticity of this fact, yet the experiments were severely criticized, as well as the observations which they seemed to confirm. It was contended that the air must have come to these animals through some imperceptible hole which escaped the notice of the observer. Some probability, however, was given to this circumstance by some researches of Dr. Edwards, published in 1817. He has observed that toads, shut up totally in plaster, and absolutely deprived of air, live for a great number of days, and much longer than those which were forced to remain under water. This certainly is one of the most extraordinary phenomena which the history of reptiles can furnish. It appears an exception to the necessity of air, which is regarded as indispensable to the life of all animals, and seems to break the chain which united them under the most interesting relations of existence. It appears, however, that the air evidently penetrated through the plaster, as Dr. Edwards proved, for the toads perished as soon as the plaster which enclosed them was placed under water. The opponents of Herissant were therefore justified to some degree in their scepticism. Still the fact of animals existing so long under such circumstances, even with a little air, is most surprising, and calculated to produce very strange reflections. If these reptiles lived in this manner longer than they would have done in the open dry air, the reason is that they lost less by transpiration, and if they died much later than they would have done in water, it was because the air certainly had some access to them. See Supplementary Note, p. 359.—Ed.

the operation, thus much I can assert, that there is neither pain nor nauseousness in it. The animal is put into a linen bag all but its head, and that is held to the part. It has generally instantly laid hold of the foulest part of the sore, and sucked with greediness until it dropped off dead. It has frequently happened that the creature has swollen immediately, and from its agonies, appeared to be in great pain. I have weighed them for several days together, before and after the application, and found their increase of weight, in their different degrees, from a drachm to near an ounce. They frequently sweat exceedingly, and turn quite pale, sometimes they disgorge, recover, and become lively again: I think the whole scene is surprising, and a very remarkable piece of natural history. From the constant inoffensiveness which I have observed in them, I almost question the truth of their poisonous spitting. Many people here expect no great good from the application of toads to cancers; and where the disorder is not absolutely local, none is to be expected. When it is seated in any part not to be well come at for extirpation, I think it is hardly to be imagined, but that the having it sucked clean as often as you please, must give great relief. Everybody knows that dogs licking of sores cures them; which is, I suppose, chiefly by keeping them clean. If there be any credit to be given to history, poisons have been sucked out. *Pallentia vulnera lambit ore venena trahens*, are the words of Lucan on the occasion. If the people to whom these words are applied did their cure by immediately following the injection of the poison, the local confinement of another poison brings the case to a great degree of similarity. I hope I have not tired your lordship with my long tale: as it is a true one, and, in my apprehension, a curious piece of natural history, I could not forbear communicating it to you. I own I thought the story in the papers to be an invention; and when I considered the instinctive principle in all animals of self-preservation, I was confirmed in my disbelief: but what I have related I saw; and all theory must yield to fact. It is only the Rubeth, the land-toad, which has the property of sucking; I cannot find any, the least, mention of the property in any one of the old naturalists. My patient can bear to have but one applied in twenty-four hours. The woman who was cured had them on day and night, without intermission, for five weeks. Their time of hanging at the breast has been from one to six hours.”

Other remarks made upon their method of performing this extraordinary operation are as follow: “Some toads die very soon after they have sucked; others live about a quarter of an hour, and some much longer. For example, one that was applied about seven o'clock sucked till ten, and died as soon as it was taken from the breast; another that immediately succeeded continued till three o'clock, but dropped dead from the

wound: each swelled exceedingly, and grew of a pale colour. They do not seem to suck greedily, and often turn their heads away; but during the time of their sucking, they were heard to smack their lips like a young child.⁶

From this circumstantial account of the progress of this extraordinary application, one could hardly suppose that any doubt could remain of the ingenious observer's accuracy; and yet, from information which I have received from authority still more respectable, there is much reason, as yet, to suspend our assent. A lady who was under the care of the present president of the College of Physicians, was induced by her friends to try the experiment; and as he saw the case was desperate, and that it would quiet her mind as well as theirs, he permitted the trial. During the whole continuance of their application, she could never thoroughly perceive that they sucked her; but that did not prevent their swelling and dying, as in the former instances. Once indeed, she said she thought that one of them seemed to suck; but the physician, and those who attended, could not perceive any appearance of it. Thus, after all, it is a doubt whether these animals die by the internal or the external application of the cancerous poison.

Of this animal there are several varieties: such as the water and the land toad, which probably differ only in the ground-colour of their skin. In the first, it is more inclining to ash-colour, with brown spots; in the other, the colour is brown, approaching to black. The water toad is not so large as the other; but both equally breed in that element. The size of the toad, with us, is generally from two to four inches long; but in the fenny countries of Europe I have seen them much larger, and not less than a common crab, when brought to table. But this is nothing to what they are found in some of the tropical climates, where travellers often, for the first time, mistake a toad for a tortoise. Their usual size is from six to seven inches: but there are some still larger, and as broad as a plate. Of these some are beautifully streaked and coloured; some studded over as with pearls; others bristled with thorns or spines; some have the head distinct from the body, while others have it so sunk in that the animal appears without a head.⁷ All these are found in the tropical climates in great abundance, and particularly after a shower

of rain. It is then that the streets seem entirely paved with them; they then crawl from their retreats, and go into all places to enjoy their favourite moisture. With us the opinion of its raining toads and frogs has long been justly exploded; but it still is entertained in the tropical countries; and that not only by the savage natives, but the more refined settlers, who are apt enough to add the prejudices of other nations to their own.

It would be a tedious, as well as useless task, to enter into all the discriminations of these animals, as found in different countries or places; but the pipal, or Surinam toad, is too strange a creature not to require an exact description. There is not, perhaps, in all nature, a more extraordinary phenomenon than that of an animal breeding and hatching its young in its back; from whence, as from a kind of hot-bed, they crawl one after the other when come to maturity.

The pipal is, in form, more hideous than even the common toad; nature seeming to have marked all those strange mannered animals with peculiar deformity. The body is flat and broad; the head small; the jaws, like those of a mole, are extended, and evidently formed for rooting in the ground: the skin of the neck forms a sort of wrinkled collar: the colour of the head is of a dark chestnut, and the eyes are small: the back, which is very broad, is of a lightish gray, and seems covered over with a number of small eyes, which are round, and placed at nearly equal distances. These eyes are very different from what they seem; they are the animal's eggs, covered with their shells, and placed there for hatching. These eggs are buried deep in the skin, and in the beginning of incubation but just appear; and are very visible when the young animal is about to burst from its confinement. They are of a reddish shining yellow colour; and the spaces between them are full of small warts resembling pearls.⁸

This is their situation previous to their coming forth; but nothing so much demands our admiration as the manner of their production. The eggs, when formed in the ovary, are sent by some internal canals, which anatomists have not hitherto described, to lie, and come to maturity, under the bony substance of the back; in this state they are impregnated by the male, whose seed finds its way by pores very singularly contrived, and pierces not only the skin but the periosteum. The skin, however, is still apparently entire, and forms a very thick covering over the whole brood; but as they advance to maturity,

⁸ It is now demonstrated that the female lays its eggs after the manner of toads, but that the male, fastened on her back, fecundates them, and then places them on the back of the mother; she then repairs to the water, where her skin swells, and forms rounded alveoli, in which these eggs are lodged, to be subsequently disclosed.—Ed.

⁶ British Zoology, vol. iii. p. 338.

⁷ Among this numerous family there is one which, for horrid and deformed appearance, probably exceeds all other created beings. This is the horned toad, of South America. The colour is cinereous, with brown stripes. The eye-lids project in a singular manner, and give it the appearance as if the eyes were placed at the bottom of a pair of sharp-pointed horns: the head is very large, and the mouth is so enormous, as to exceed half the length of its body. To add to its loathsome appearance, it is likewise clothed all over, except the head and feet, with short sharp spines.—Ed.

at different intervals, one after another, the egg seems to start forward and bourgeon from the back, becomes more yellow, and at last breaks, when the young one puts forth its head: it still, however, keeps its situation, until it has acquired a proper degree of strength, and then it leaves the shell, but still continues to keep upon the back of the parent. In this manner the pipal is seen travelling with her wondrous family on her back, in all the different stages of maturity. Some of the strange progeny, not yet come to sufficient perfection, appear quite torpid, and as yet without life in the egg: others seem just beginning to rise through the skin; here peeping forth from the shell, and there having entirely forsaken their prison; some are sporting at large upon the parent's back, and others descending to the ground to try their own fortune below.

Such is the description given of this strange production by Seba, in which he differs from Raysch, who affirms, that the young ones are bred in the back of the male only, where the female lays her eggs. I have followed Seba, however, not because he is better authority, but because he is more positive of the truth of his account, and asserts assuredly that the eggs are found on the back of the female only. Many circumstances, however, are wanting towards completing his information; such as a description of the passage by which the egg finds its way into the back; the manner of its fecundation; the time of gestation; as also a history of the manners of this strange animal itself; but, by a prolixity that much prevails among naturalists at present, he leaves the most interesting object of curiosity to give us a detailed description of the legs and claws of the pipal, about which we have very little concern.

The male pipal is every way larger than the female, and has the skin less tightly drawn round the body. The whole body is covered with pustules resembling pearls; and the belly, which is of a bright yellow, seems as if it were sewed up from the throat to the vent, a seam being seen to run in that direction. This animal, like the rest of the frog-kind, is most probably harmless; though we are told of the terrible effects resulting from its powder when calcined. This, however, must certainly be false; no creature whatever, when calcined, can be poisonous; for the fire burns away whatever might have been dangerous in their composition: all animal substances, when calcined, being entirely the same.

NOTE.—On the Vitality of Toads.

"In the month of November 1825," says Dr. Buckland, in a paper contributed by him to the 'Edinburgh New Philosophical Journal,' "I commenced the following experiments with a view to explain the frequent discoveries of toads enclosed within blocks of stone and wood, in cavities that are said to have no communication with the external air.

"In one large block of coarse oolitic limestone (the Oxford oolite from the quarries of Heddington), twelve circular cells were prepared, each about one foot deep and five inches in diameter, and having a groove or shoulder at its upper margin fitted to receive a circular plate of glass, and a circular slate to protect the glass; the margin of this double cover was closed round, and rendered impenetrable to air and water by a luting of soft clay. Twelve smaller cells, each six inches deep and five inches in diameter, were made in another block of compact siliceous sandstone, viz., the Pennant grit of the coal formation near Bristol; these cells also were covered with similar plates of glass and slate, cemented at the edge by clay. The object of the glass covers was to allow the animals to be inspected, without disturbing the clay so as to admit external air or insects into the cell. The limestone is so porous that it is easily permeable by water, and probably also by air; the sandstone is very compact. On the 26th of November, 1825, one live toad was placed in each of the above-mentioned twenty-four cells, and the double cover of glass and slate placed over each of them and cemented down by the luting of clay; the weight of each toad in grains was ascertained and noted by Dr. Daubeny and Mr. Dillwyn, at the time of their being placed in the cells; that of the smallest was 115 grains, and of the largest 1,185 grains. The large and small animals were distributed in equal proportion between the limestone and the sandstone cells. These blocks of stone were buried together in my garden beneath three feet of earth, and remained unopened until the 10th of December 1826, on which day they were examined. Every toad in the smaller cells of the compact sandstone was dead, and the bodies of most of them so much decayed, that they must have been dead some months. The greater number of those in the larger cells of porous limestone were alive. No. 1, whose weight when immured was 924 grains, now weighed only 698 grains. No. 5, whose weight when immured was 1,185 grains, now weighed 1,265 grains. The glass cover over this cell was slightly cracked, so that minute insects might have entered; none, however, were discovered in this cell; but in another cell, whose glass was broken, and the animal within it dead, there was a large number of minute insects, and a similar assemblage also on the outside of the glass of a third cell. In the cell No. 9, a toad which, when put in, weighed 988 grains, had increased to 1,116 grains, and the glass over it was entire; but as the luting of the cell within which this toad had increased in weight was not particularly examined, it is probable there was some aperture in it by which small insects found admission. No. 11, had decreased from 936 grains to 652 grains.

"When they were first examined in December 1826, not only were all the small toads dead, but the larger ones appeared much emaciated, with the two exceptions above-mentioned. We have already stated that these probably owed their increased weight to the insects which had found access to the cells and become their food. The death of every individual of every size in the smaller cells of compact sandstone, appears to have resulted from a deficiency in the supply of air, in consequence of the smallness of the cells, and the impermeable nature of the stone; the larger volume of air originally enclosed in the cells of the limestone, and the porous nature of this stone itself (permeable as it is slowly by water and probably also by air) seems to have favoured the duration of life to the animals enclosed in them without food. It should be noticed that there is a defect in these experiments arising from the treatment of the twenty-four toads before they were enclosed in the blocks of stone. They were shut up and buried on the 26th of November, but the greater number of them had been caught more than two months before

that time, and had been imprisoned altogether in a cucumber frame placed on common garden earth, where the supply of food to so many individuals was probably scanty, and their confinement unnatural, so that they were in an unhealthy and somewhat meagre state at the time of their imprisonment. We can therefore scarcely argue with certainty from the death of all these individuals within two years, as to the duration of life which might have been maintained had they retired spontaneously and fallen into the torpor of their natural hybernization in good bodily condition.

"The results of our experiments amount to this: all the toads both large and small enclosed in sandstone, and the small toads in limestone also, were dead at the end of thirteen months. Before the expiration of the second year, all the large ones also were dead; these were examined several times during the second year through the glass covers of the cells, but without removing them to admit air; they appeared always awake with their eyes open, and never in a state of torpor, their meagreness increasing at each interval in which they were examined, until at length they were found dead; those two, also, which had gained an accession of weight at the end of the first year, and were then carefully closed up again, were emaciated and dead before the expiration of the second year. At the same time that these toads were enclosed in stone, four other toads of middling size were enclosed in three holes cut for this purpose, on the north side of the trunk of an apple-tree; two being placed in the largest cell, and each of the others in a single cell; the cells were nearly circular, about five inches deep and three inches in diameter; they were carefully closed up with a plug of wood, so as to exclude access of insects, and apparently were air-tight; when examined at the end of a year, every one of the toads was dead and their bodies were decayed. From the fatal result of the experiments made in the small cells cut in the apple-tree, and the block of compact sandstone, it seems to follow that toads cannot live a year excluded totally from atmospheric air; and from the experiments in the larger cells within the block of oolite limestone, it seems probable that they cannot survive two years entirely excluded from food; we may therefore conclude, that there is a want of sufficiently minute and accurate observation in those so frequently recorded cases, where toads are said to be found alive within blocks of stones and wood, in cavities that had no communication whatever with the external air. The fact of my two toads having increased in weight at the end of a year, notwithstanding the care that was taken to enclose them perfectly by a luting of clay, shows how very small an aperture will admit minute insects sufficient to maintain life. In the cell No. 5, where the glass was slightly cracked, the communication though small was obvious; but in the cell No. 9, where the glass cover remained entire, and where it appears certain from the increased weight of the enclosed animal, that insects must have found admission, we have an example of these minute animals finding their way into a cell, to which great care had been taken to prevent any possibility of access.

"Admitting, then, that toads are occasionally found in cavities of wood and stone, with which there is no communication sufficiently large to allow the ingress and egress of the animal enclosed in them, we may, I think, find a solution of such phenomena in the habits of these reptiles, and of the insects which form their food. The first effort of the young toad, as soon as it has left its tadpole state and emerged from the water, is to seek shelter in holes and crevices of rocks and trees. An individual, which, when young, may have thus entered a cavity by some very narrow aperture, would find abundance

of food by catching insects, which like itself seek shelter within such cavities, and may soon have increased so much in bulk as to render it impossible to go out again, through the narrow aperture at which it entered. A small hole of this kind is very likely to be overlooked by common workmen, who are the only people whose operations on stone and wood disclose cavities in the interior of such substances. In the case of toads, snakes, and lizards, that occasionally issue from stones that are broken in a quarry, or in sinking wells, and sometimes even from strata of coal at the bottom of a coal mine, the evidence is never perfect to show that the reptiles were entirely enclosed in a solid rock; no examination is ever made until the reptile is first discovered by the breaking of the mass in which it was contained, and then it is too late to ascertain without carefully replacing every fragment (and in no case that I have seen reported has this ever been done) whether or not there was any hole or crevice by which the animal may have entered the cavity from which it was extracted. Without previous examination it is almost impossible to prove that there was no such communication. In the case of rocks near the surface of the earth, and in stone quarries, reptiles find ready admission to holes and fissures. We have a notorious example of this kind in the lizard found in a chalk pit, and brought alive to the late Dr. Clarke. In the case also of wells and coal-pits, a reptile that had fallen down the well or shaft, and survived its fall, would seek its natural retreat in the first hole or crevice it could find, and the miner dislodging it from this cavity to which his previous attention had not been called, might in ignorance conclude that the animal was coeval with the stone from which he had extracted it.

"It remains only to consider the case, (of which I know not any authenticated example,) of toads that have been said to be found in cavities within blocks of limestone to which, on careful examination, no access whatever could be discovered, and where the animal was absolutely and entirely closed up with stone. Should any such case ever have existed, it is probable that the communication between this cavity and the external surface had been closed up by stalactitic incrustation after the animal had become too large to make its escape. A similar explanation may be offered of the much more probable case of a live toad being entirely surrounded with solid wood. In each case the animal would have continued to increase in bulk so long as the smallest aperture remained by which air and insects could find admission; it would probably become torpid as soon as this aperture was entirely closed by the accumulation of stalactite or the growth of wood; but it still remains to be ascertained how long this state of torpor may continue under total exclusion from food, and from external air: and although the experiments above-recorded show that life did not extend two years in the case of any one of the individuals which formed the subjects of them, yet for reasons which have been specified, they are not decisive to show that a state of torpor, or suspended animation, may not be endured for a much longer time by toads that are healthy and well fed, up to the moment when they are finally cut off from food, and from all direct access to atmospheric air. The common experiment of burying a toad in a flower-pot covered with a tile, is of no value, unless the cover be carefully luted to the pot, and the hole at the bottom of the pot also closed, so as to exclude all possible access of air, earthworms and insects. I have heard of two or three experiments of this kind, in which these precautions have not been taken, and in which, at the end of a year, the toads have been found alive and well.

"Besides the toads enclosed in stone and wood,

four others were placed each in a small basin of plaster of Paris, four inches deep and five inches in diameter, having a cover of the same material carefully luted round with clay; these were buried at the same time and in the same place with the blocks of stone, and on being examined at the same time with them in December 1826, two of the toads were dead, the other two alive, but much emaciated. We can only collect from this experiment, that a thin plate of plaster of Paris is permeable to air in a sufficient degree to maintain the life of a toad for thirteen months. In the 19th vol. No. 1, p. 167, of 'Silliman's American Journal of Science and Arts,' David Thomas, Esq.,

has published some observations on frogs and toads in stone and solid earth, enumerating several authentic and well attested cases; these, however, amount to no more than a repetition of the facts so often stated and admitted to be true, viz., that torpid reptiles occur in cavities of stone, and at the depth of many feet in soil and earth; but they state not any thing to disprove the possibility of a small aperture, by which these cavities may have had communication with the external surface, and insects have been admitted. The attention of the discoverer is always directed more to the toad than to the minutiae of the state of the cavity in which it was contained."

BOOK II.

OF THE LIZARD KIND.

CHAP. I.

OF LIZARDS IN GENERAL.

THERE is scarcely a naturalist, who has treated of lizards, but has a particular manner of ranking them in the scale of animated nature. Ray, rather struck with the number of their legs than their habits and conformation, has exalted them among quadrupeds; while Linnæus, attentive only to their long slender forms, has degraded them among serpents, Brisson gives them a distinct class by themselves, under the name of *reptiles*. Klein gives them a class inferior to beasts, under the name of *naked quadrupeds*. Some, in short, from their scaly covering, and fondness for the water, have given them to the fishes; while there have not been wanting naturalists who have classed them with insects, as the smaller kinds of this class seem to demand.

It is indeed no easy matter to tell to what class in nature lizards are chiefly allied. They are unjustly raised to the rank of beasts, as they bring forth eggs, dispense with breathing, and are not covered with hair. They cannot be placed among fishes, as the majority of them live upon land: they are excluded from the serpent tribe by their feet, upon which they run with some celerity: and from the insects, by their size; for though the newt may be looked upon in this contemptible light, a crocodile would be a terrible insect indeed. Thus lizards are, in some measure, excluded from every rank, while they exhibit somewhat of the properties of all: the legs and celerity of the quadruped; a facility of creeping through narrow and intricate ways, like the serpent; and a power of living in the water, like fishes; however, though endued with these various powers, they have no real ad-

vantages over any other class of animated nature; for what they gain in aptitude for one element, they lose in their fitness for another. Thus, between both, they are an awkward ungainly tribe; neither so alert upon land, nor so nimble in the water, as the respective inhabitants of either abode: and, indeed, this holds throughout all nature, that in proportion as the seeming advantages of inferior animals are multiplied, their real ones are abridged; and all their instincts are weakened and lost by the variety of channels into which they are divided.

As lizards thus differ from every other class of animals, they also differ widely from each other. With respect to size, no class of beings has its ranks so opposite. What, for instance, can be more removed than the small caméléon, an inch long, and the alligator of the river Amazon, above twenty-seven feet? To an inattentive observer, they would appear entirely of different kinds; and Seba wonders how they ever came to be classed together.

The colour of these animals also is very various, as they are found of a hundred different hues—green, blue, red, chestnut, yellow, spotted, streaked, and marbled. Were colour alone capable of constituting beauty, the lizard would often please; but there is something so repressing in the animal's figure, that the brilliancy of its scales, or the variety of its spots, only tend to give an air of more exquisite venom or greater malignity. The figure of these animals is not less various: sometimes swollen in the belly; sometimes pursed up at the throat; sometimes with a rough set of spines on the back, like the teeth of a saw; sometimes with teeth, at others with none; sometimes venomous, at others harmless, and even philanthropic; sometimes smooth and

even; sometimes with a long slender tail; and oftener with a shorter blunt one.¹

But their greatest distinction arises from the manner of bringing forth their young. First, some of them are viviparous. Secondly, some are oviparous; and which may be considered in three distinct ways. Thirdly, some bring forth small spawn, like fishes. The crocodile, the iguana, and all the larger kinds, bring forth eggs, which are hatched by the heat of the sun; the animals that issue from them are complete upon leaving the shell; and their first efforts are to run to seek food in their proper element. The viviparous kinds, in which are all the salamanders, come forth alive from the body of the female, perfect and active, and suffer no succeeding change. But those which are bred in the water, and as we have reason to think, from spawn, suffer a very considerable change in their form. They are produced with an external skin or covering that sometimes encloses their feet, and gives them a serpentine appearance. To this false skin fins are added, above and below the tail, that serve the animal for swimming; but when the false skin drops off, these drop off also; and then the lizard, with its four feet, is completely formed, and forsakes the water.

From hence it appears, that of this tribe there are three distinct kinds, differently produced, and, most probably, very different in their formation. But the history of these animals is very obscure; and we are, as yet, incapable of laying the line that separates them. All we know, as was said before, is, that the great animals of this kind are *mostly* produced perfect from the egg; the salamanders are *generally* viviparous; and *some* of the water-lizards imperfectly produced. In all these most unfinished productions of Nature, if I may so call them, the varieties in their structure increase in proportion to their imperfections. A poet would say, that Nature grew tired of the nauseous formation, and left accident to finish the rest of her handy-work.

However, the three kinds have many points of similitude; and, in all their varieties of figure, colour, and production, this tribe is easily distinguished, and strongly marked. They have all four short legs; the two fore-feet somewhat resembling a man's hand and arm. They have tails almost as thick as the body at the beginning, and that generally run tapering to a point. They are all amphibious also; equally capable of living upon land and water; and formed, internally, in the same manner with the tortoise, and other animals, that can continue a long time without respiration: in other words, their lungs are not so necessary to continue life and circulation, but that their play may be stopped for

¹ The whole of this tribe is perfectly destitute of poison, and, except the crocodile and alligator, quite inoffensive to mankind. Those that are bred in waters undergo a metamorphosis, and pass through a tadpole form.—ED.

some considerable time, while the blood performs its circuit round the body by a shorter communication.

These are differences that sufficiently separate lizards from all other animals; but it will be very difficult to fix the limits that distinguish the three kinds from each other. The crocodile tribe, and its affinities, are sufficiently distinguished from all the rest by their size and fierceness; the *salamander* tribe is distinguished by their deformity, their frog-like heads, the shortness of their snouts, their swollen bellies, and their viviparous production. With regard to the rest, which we may denominate the *cameleon* or lizard kind, some of which bring forth from the egg, some of which are imperfectly formed from spawn, we must group them under one head, and leave time to unravel the rest of their history.

CHAP. II.

OF THE CROCODILE, AND ITS AFFINITIES.

THE Crocodile is an animal placed at a happy distance from the inhabitants of Europe, and formidable only in those regions where men are scarce, and arts but little known. In all the cultivated and populous parts of the world, the great animals are entirely banished, or rarely seen. The appearance of such raises at once a whole country up in arms to oppose their force; and their lives generally pay the forfeit of their temerity. The crocodile, therefore, that was once so terrible along the banks of the river Nile, is now neither so large nor its numbers so great as formerly. The arts of mankind have, through a course of ages, powerfully operated to its destruction; and, though it is sometimes seen, it appears comparatively timorous and feeble.

To look for this animal in all its natural terrors, grown to an enormous size, propagated in surprising numbers, and committing unceasing devastations, we must go to the uninhabited regions of Africa and America, to those immense rivers that roll through extensive and desolate kingdoms, where arts have never penetrated, where force only makes distinction, and the most powerful animals exert their strength with confidence and security. Those that sail up the river Amazon, or the river Niger, well know how numerous and terrible those animals are in such parts of the world. In both these rivers, they are found from eighteen, to twenty-seven feet long; and sometimes lying as close to each other as rafts of timber upon one of our streams. There they indolently bask on the surface, no way disturbed at the approach of an enemy, since, from the repeated trials of their strength, they found none that they were not able to subdue.

Of this terrible animal there are two kinds; the Crocodile, properly so called, and the Cayman or Alligator. Travellers, however, have rather made the distinctions than Nature; for in the general outline, and in the nature of these two animals, they are entirely the same. It would be speaking more properly to call these animals the Crocodiles of the eastern and western world; for, in books of voyages, they are so entirely confounded together, that there is no knowing whether the Asiatic animal be the crocodile of Asia, or the alligator of the western world. The distinctions usually made between the crocodile and alligator are these: the body of the crocodile is more slender than that of the alligator; its snout runs off tapering from the forehead, like that of a greyhound; while that of the other is indented, like the nose of a lap-dog. The crocodile has a much wider swallow, and is of an ash-colour; the alligator is black, varied with white, and is thought not to be so mischievous. All these distinctions, however, are very slight; and can be reckoned little more than minute variations.¹

This animal grows to a great length, being sometimes found thirty feet long, from the tip of the snout to the end of the tail: its most usual length, however, is eighteen. One which was dissected by the Jesuits at Siam, was of the latter dimensions; and as the description which is given of it, both externally and internally, is the most accurate known of this noted animal, I must beg leave to give it as I find it, though somewhat tedious. It was eighteen feet and a half, French measure, in length; of which the tail was no less than five feet and a half, and the head and neck above two feet and a half. It was four feet nine inches in circumference, where thickest. The fore-legs had the same parts and conformation as the arms of a man, both within and without. The hands, if they may be so called, had five fingers; the two last of which had no nails, and were of a conical figure. The hinder legs, including the thigh and paw, were two feet two inches long; the paws, from the joint to the extremity of the longest claws, were above nine inches; they were divided into four toes, of which three were armed with large claws, the longest of which was an inch and a half; these toes were united by a membrane, like those of a duck, but much thicker. The head was long, and had a little rising at the top; but the rest was flat, and especially toward the extremity of the jaws. It was covered by a skin, which adhered firmly to the skull and to the jaws. The skull was rough and unequal in several places; and about the middle of the forehead there were two bony crests, about two inches high: the skull between these two crests was proof against a musket-ball; for it only rendered the part a little white that it struck against.

The eye was very small, in proportion to the rest of the body, and was so placed within its orbit, that the outward part, when the lid was closed, was only an inch long, and the line running parallel to the opening of the jaws. It was covered with a double lid, one within and one without: that within, like the nictitating membrane in birds, was folded in the great corner of the eye, and had a motion towards the tail, but being transparent, it covered the eye without hindering the sight. The iris was very large in proportion to the globe of the eye, and was of a yellowish gray colour. Above the eye the ear was placed, which opened from above downwards, as if it were by a kind of spring, by means of a solid, thick, cartilaginous substance. The nose was placed in the middle of the upper jaw, near an inch from its extremity, and was perfectly round and flat, being near two inches in diameter, of a black, soft, spongy substance, not unlike the nose of a dog. The jaws seemed to shut one within another; and nothing can be more false than that the animal's under jaw is without motion; it moves like the lower jaw in all other animals, while the upper is fixed to the skull, and absolutely immoveable. The animal had twenty-seven cutting teeth in the upper jaw, and fifteen in the lower, with several void spaces between them: they were thick at the bottom, and sharp at the point, being all of different sizes, except ten large hooked ones, six of which were in the lower jaw, and four in the upper. The mouth was fifteen inches in length, and eight and a half in breadth, where broadest. The distance of the two jaws, when opened as wide as they could be, was fifteen inches and a half; this is a very wide yawn, and could easily enough take in the body of a man. The colour of the body was of a dark brown on the upper part, and of a whitish citron below, with large spots of both colours on the sides. From the shoulders to the extremity of the tail, the animal was covered with large scales, of a square form, disposed like parallel girdles, and fifty-two in number; but those near the tail were not so thick as the rest. The creature was covered not only with these, but all over with a coat of armour; which, however, was not proof against a musket-ball, contrary to what has been commonly asserted: however, it must be confessed, that the attitude in which the animal was placed, might contribute to render the skin more penetrable; for, probably, if the ball had struck obliquely against the shell it would have flown off. Those parts of the girdles underneath the belly were of a whitish colour, and were made up of scales of divers shapes, but not so hard as those on the back.

With respect to the internal parts of the animal, the gullet was large in proportion to the mouth; and a ball of wood, as large as one's head, readily ran down, and was drawn up again. The guts were but short, in comparison, being not so long as the animal's body. The tongue,

¹ See Supplementary Note at end of chapter.

which some have erroneously asserted this animal was without, consisted of a thick, spongy, soft flesh, and was strongly connected to the lower jaw. The heart was of the size of a calf's, of a bright red colour, the blood passing as well from the veins to the aorta as into the lungs. There was no bladder; but the kidneys sent the urine to be discharged by the anus. There were sixty-two joints in the back-bone, which, though very closely united, had sufficient play to enable the animal to bend like a bow to the right and the left; so that what we hear of escaping the creature by turning out of the right line, and of the animal not being able to wheel readily after its prey, seems to be fabulous. It is most likely the crocodile can turn with ease, for the joints of its back are not stiffer than those of other animals, which we know, by experience, can wheel about very nimbly for their size.

Such is the figure and conformation of this formidable animal, that unpeopled countries, and makes the most navigable rivers desert and dangerous. They are seen, in some places, lying for whole hours, and even days, stretched in the sun, and motionless; so that one not used to them might mistake them for trunks of trees, covered with a rough and dry bark; but the mistake would soon be fatal if not prevented; for the torpid animal, at the near approach of any living thing, darts upon it with instant swiftness, and at once drags it down to the bottom. In the times of inundation, they sometimes enter the cottages of the natives, where the dreadful visitant seizes the first animal it meets with. There have been several instances of their taking a man out of a canoe in the sight of his companions, without their being able to lend him any assistance.

The strength of every part of the crocodile is very great; and its arms, both offensive and defensive, irresistible. We have seen, from the shortness of its legs, the amazing strength of the tortoise: but what is the strength of such an animal compared to that of the crocodile, whose legs are very short, and whose size is so superior! The back-bone is jointed in the firmest manner; the muscles of the fore and hinder legs are vigorous and strong; and its whole form calculated for force. Its teeth are sharp, numerous, and formidable; its claws are long and tenacious; but its principal instrument of destruction is the tail: with a single blow of this it has often overturned a canoe, and seized upon the poor savage its conductor.

Though not so powerful, yet it is very terrible even upon land. The crocodile seldom, except when pressed by hunger, or with a view of depositing its eggs, leaves the water. Its usual method is to float along upon the surface, and seize whatever animals come within its reach; but when this method fails, it then goes closer to the bank. Disappointed of its fishy prey, it there waits, covered up among the sedges, in patient

expectation of some land animal that comes to drink; the dog, the bull, the tiger, or man himself. Nothing is to be seen of the insidious destroyer as the animal approaches; nor is its retreat discovered till it be too late for safety. It seizes the victim with a spring, and goes at a bound much farther than so unwieldy an animal could be thought capable of exerting; then having secured the creature with both teeth and claws, it drags it into the water, instantly sinks with it to the bottom, and, in this manner, quickly drowns it.

Sometimes it happens that the creature the crocodile has thus surprised escapes from its grasp wounded, and makes off from the river side. In such a case the tyrant pursues with all its force, and often seizes it a second time; for, though seemingly heavy, the crocodile runs with great celerity. In this manner it is sometimes seen above half-a-mile from the bank, in pursuit of an animal wounded beyond the power of escaping, and then dragging it back to the river side, where it feasts in security.

It often happens, in its depredations along the bank, that the crocodile seizes on a creature as formidable as itself, and meets with a most desperate resistance. We are told of frequent combats between the crocodile and the tiger. All creatures of the tiger kind are continually oppressed by a parching thirst, that keeps them in the vicinity of great rivers, whither they descend to drink very frequently. It is upon these occasions that they are seized by the crocodile; and they die not unrevenged. The instant they are seized upon, they turn with the greatest agility, and force their claws into the crocodile's eyes, while he plunges with his fierce antagonist into the river. There they continue to struggle for some time, till at last the tiger is drowned.

In this manner the crocodile seizes and destroys all animals, and is equally dreaded by all. There is no animal but man alone can combat it with success. We are assured by Labat, that a negro, with no other weapons than a knife in his right hand, and his left arm wrapped round with a cow-hide, ventures boldly to attack this animal in his own element. As soon as he approaches the crocodile, he presents his left arm, which the animal swallows most greedily; but sticking in its throat, the negro has time to give it several stabs under the throat; and the water also getting in at the mouth, which is held involuntarily open, the creature is soon bloated up as big as a tun, and expires.

To us who live at a distance from the rapacity of these animals, these stories appear strange, and yet most probably are true. From not having seen any thing so formidable or bold in the circle of our own experience, we are not to determine upon the wonderful transactions in distant climates. It is probable that these and a number of more dreadful encounters, happen every day among those forests and in those rivers

where the most formidable animals are known to reside; where the elephant and the rhinoceros, the tiger and the hippopotamus, the shark and the crocodile, have frequent opportunities of meeting, and every day of renewing their engagements.

Whatever be the truth of these accounts, certain it is that crocodiles are taken by the Siamese in great abundance. The natives of that empire seem particularly fond of the capture of all the great animals with which their country abounds. We have already seen their success in taking and taming the elephant; nor are they less powerful in exerting their dominion over the crocodile. The manner of taking it in Siam, is by throwing three or four strong nets across a river, at proper distances from each other; so that if the animal breaks through the first, it may be caught by one of the rest. When it is first taken, it employs the tail, which is the grand instrument of strength, with great force; but after many unsuccessful struggles, the animal's strength is at last exhausted. Then the natives approach their prisoner in boats, and pierce him with their weapons in the most tender parts, till he is weakened by the loss of blood. When he has done stirring, they begin by tying up his mouth, and with the same cord they fasten his head to his tail, which last they bend back like a bow. However, they are not yet perfectly secure from his fury; but, for their greater safety, they tie his fore-feet, as well as those behind, to the top of his back. These precautions are not useless: for if they were to omit them, the crocodile would soon recover strength enough to do a great deal of mischief.

The crocodile, thus brought into subjection, or bred up young, is used to divert and entertain the great men of the East. It is often managed like a horse; a curb is put into its mouth, and the rider directs it as he thinks proper.² Though

² Many people altogether disbelieve Waterton's account of catching the crocodile, or the cayman, and laugh at the extreme improbability of his having "jumped on his back," in order to conquer him. This the greater part of his readers have looked upon as a fiction; and others have considered it as a downright falsehood. The following observations will tend to counteract this idea, and to show that it has actually been the custom, among some nations, both in ancient and modern times, to mount on the backs of crocodiles, that these animals may be taken with more facility and safety. Pliny gives this curious description of catching crocodiles:—"There is a race of men hostile to the crocodile, called Tentyritæ, from an island in the Nile itself, which they inhabit. Their stature is small, but their courage in this practice is wonderful. This beast is terrible to them that flee from him, but runs away from his pursuers, and these men alone dare attack him. Moreover, they swim after him in the river, and mounting on his back, like horsemen, as he opens his jaws to bite, with his head turned up, they thrust a club into his mouth, and holding the ends of it, one in the right hand, and the other in the left, they bring him to shore captive as if with bridles, and so frightened with their shouts only, that they compel

awkwardly formed, it does not fail to proceed with some degree of swiftness; and it is thought to move as fast as some of the most unwieldy of our own animals, the hog or the cow. Some, indeed, assert, that no animal could escape it, but for its difficulty in turning; but to this resource we could wish none would trust who are so unhappy as to find themselves in danger.

Along the rivers of Africa this animal is sometimes taken in the same manner as the shark. Several Europeans go together in a large boat, and throw out a piece of beef upon a hook and strong fortified line, which the crocodile seizing and swallowing, is drawn along, floundering and struggling until its strength is quite exhausted, when it is pierced in the belly, which is its tenderest part; and thus, after numberless wounds, is drawn ashore. In this part of the world also, as well as at Siam, the crocodile makes an object of savage pomp near the palaces of their monarchs. Philips informs us, that at Sabi, on the slave coast, there are two pools of water, near the royal palace, where crocodiles are bred, as we breed carp in our ponds in Europe.

him to disgorge the bodies he had but just swallowed, in order to be buried." Dr. Pococke, in his observations on Egypt, mentions a method of taking the crocodile still more like that which Waterton practised in South America. He says, "They make some animal cry at a distance from the river, and when the crocodile comes out, they thrust a spear into his body, to which a rope is tied; they then let him go into the water to spend himself, and afterwards drawing him out, run a pole into his mouth, and, *jumping on his back*, tie his jaws together." Now, Mr. Waterton and his Indians having secured a monster of the Essequibo, by a baited hook fastened to a long rope, "they pulled the cayman," as he describes, "within two yards of me, I saw he was in a state of fear and perturbation; I instantly dropped the mast, sprung up, and *jumped on his back*, turning half round as I vaulted, so that I gained my seat with my face in a right position. I immediately seized his fore legs, and by main force twisted on his back: thus they served me for a bridle." Herodotus relates a different way of catching this animal on the Nile.—"When they have fixed a piece of swine's flesh on a hook, they cast it into the middle of the river; and on the bank they have a live pig, which they beat. The crocodile, hearing the squeaking, goes to the noise; and, having seized the flesh, devours it: they then pull him; and when they have dragged him on shore, they first of all fill his eyes with mud; and having done this, he is very easily despatched." Pococke and Herodotus both assert that some animal is made to cry near the river, so that by its noise the crocodile may be attracted to the spot, and we find due notice was likewise given on the banks of the Essequibo; for we read, "the Indian," having laid the bait, "then took the empty shell of a land tortoise, and gave it some heavy blows with an axe. I asked why he did that? He said, it was to let the cayman hear that something was going on. In fact, the Indian meant it as the cayman's dinner-bell." Although a ride on the back of a crocodile is not likely ever to become very fashionable, as a morning's exercise or amusement, even in this age of the "march of intellect," yet it is seen, from the above authorities, that it really is, and long has been, adopted in the process of killing these monsters of the deep.—ED.

Hitherto I have been describing the crocodile as it is found in unpeopled countries, and undisturbed by frequent encounters with mankind.³ In this state it is fierce and cruel, attacking every object that seems endued with motion: but in Egypt, and other countries long peopled, where the inhabitants are civilized, and the rivers frequented, this animal is solitary and fearful. So far from coming to attack a man, it sinks at his approach with the utmost precipitation; and, as if sensible of superior power, ever declines the engagement. We have seen more than one instance in animated nature of the contempt which at first the lower orders of the creation have for man, till they have experienced his powers of destruction. The lion and the tiger among beasts, the whale among fishes, the albatross and the penguin among birds, meet the first encounters of man without dread or apprehension; but they soon learn to acknowledge his superiority, and take refuge from his power in the deepest fastnesses of nature. This may account for the different characters which have been given us of the crocodile and the alligator, by travellers at different times; some describing them as harmless and fearful, as ever avoiding the sight of a man, and preying only upon fishes: others ranking them among the destroyers of nature; describing them as furnished with strength, and impelled by malignity, to do mischief; representing them as the greatest enemies of mankind, and particularly desirous of human prey. The truth is, the animal has been justly described by both; being such as it is found in places differently peopled or differently civilized. Wherever the crocodile has reigned long unmolested, it is there fierce, bold, and dangerous; wherever it has been harassed by mankind, its retreats invaded, and its numbers destroyed, it is there timorous and inoffensive.

In some places, therefore, this animal, instead of being formidable, is not only inoffensive, but is cherished and admired. In the river San Domingo, the crocodiles are the most inoffensive animals in nature; the children play with them, and ride about on their backs; they even beat them sometimes, without receiving the smallest injury. It is true the inhabitants are very careful of this gentle breed, and consider them as harmless domestics.

It is probable that the smell of musk, which all these animals exhale, may render them agreeable to the savages of that part of Africa. They are often known to take the part of this animal which contains the musk, and wear it as a perfume about their persons. Travellers are not

agreed in what part of the body these musk-bags are contained; some say in the ears; some, in the parts of generation; but the most probable opinion is, that this musky substance is amassed in glands under the legs and arms. From whatsoever part of the body this odour proceeds, it is very strong and powerful, tincturing the flesh of the whole body with its taste and smell. The crocodile's flesh is at best very bad tough eating; but unless the musk-bags be separated it is insupportable. The negroes themselves cannot well digest the flesh; but then, a crocodile's egg is to them the most delicate morsel in the world. Even savages exhibit their epicures as well as we; and one of true taste will spare neither pains nor danger to furnish himself with his favourite repast. For this reason, he often watches the places where the female comes to lay her eggs, and upon her retiring seizes the booty.

All crocodiles breed near fresh waters; and though they are sometimes found in the sea, yet that may be considered rather as a place of excursion than abode. They produce their young by eggs, as was said above; and for this purpose the female, when she comes to lay, chooses a place by the side of a river, or some fresh-water lake, to deposit her brood in. She always pitches upon an extensive sandy shore, where she may dig a hole without danger of detection from the ground being fresh turned up. The shore must also be gentle and shelving to the water, for the greater convenience of the animal's going and returning; and a convenient place must be found near the edge of the stream, that the young may have a shorter way to go. When all these requisites are adjusted, the animal is seen cautiously stealing upon shore to deposit her burden. The presence of a man, a beast, or even a bird, is sufficient to deter her at that time; and if she perceives any creature looking on, she infallibly returns. If, however, nothing appears, she then goes to work, scratching up the sand with her fore-paws, and making a hole pretty deep in the shore. There she deposits from eighty to a hundred eggs, of the size of a tennis-ball, and of the same figure, covered with a tough white skin like parchment. She takes above an hour to perform this task; and then covering up the place so artfully that it can scarcely be perceived, she goes back to return again the next day. Upon her return, with the same precaution as before, she lays about the same number of eggs; and the day following also a like number. Thus having deposited her whole quantity, and having covered them close up in the sand, they are soon vivified by the heat of the sun; and at the end of thirty days, the young ones begin to break open the shell. At this time the female is instinctively taught that her young ones want relief; and she goes upon land to scratch away the sand, and set them free. Her brood quickly avail themselves of their liberty; a part run unguided to the water; another part ascend the back of

³ It is a very remarkable observation, that the crocodile, when it appears out of the water, is almost surrounded by various large birds, particularly the pelican. It has been asked, whether there exists the same sympathy between these birds (especially the pelican) and the crocodile, which the heron has for buffaloes, oxen, and cows?—ED.

the female, and are carried thither in greater safety. But the moment they arrive at the water, all natural connexion is at an end; when the female has introduced her young to their natural element, not only she, but the male, become among the number of their most formidable enemies, and devour as many of them as they can. The whole brood scatters into different parts of the bottom; by far the greatest number are destroyed, and the rest find safety in their agility or minuteness.

But it is not the crocodile alone that is thus found to thin their numbers; the eggs of this animal are not only a delicious feast to the savage, but are eagerly sought after by every beast and bird of prey. The ichneumon was erected into a deity among the ancients for its success in destroying the eggs of these monsters: at present that species of the vulture called the Gallinazo is their most prevailing enemy. All along the banks of great rivers, for thousand of miles, the crocodile is seen to propagate in numbers that would soon overrun the earth, but for the vulture, that seems appointed by Providence to abridge its fecundity. These birds are ever found in greatest numbers where the crocodile is most numerous: and hiding themselves within the thick branches of the trees that shade the banks of the river, they watch the female in silence, and permit her to lay all her eggs without interruption. Then when she has retired, they encourage each other with cries to the spoil; and flocking all together upon the hidden treasure, tear up the eggs, and devour them in a much quicker time than they were deposited. Nor are they less diligent in attending the female while she is carrying her young to the water; for if any one of them happens to drop by the way, it is sure to receive no mercy.

Such is the extraordinary account given us by late travellers of the propagation of this animal; an account adopted by Linnæus and the most learned naturalists of the age.⁴ Yet, if one might argue from the general analogy of nature, the crocodile's devouring her own young when she gets to the water seems doubtful. This may be a story raised from the general idea of this animal's rapacious cruelty; when, in fact, the crocodile only seems more cruel than other animals, because it has more power to do mischief. It is probable that it is not more divested of parental tenderness than other creatures, and I am the more led to think so from the peculiar formation of one of the crocodile kind. This is called the Open-Bellied Crocodile, and is furnished with a false belly like the opossum, where the young creep out and in, as their dangers or necessities require. The crocodile thus furnished at least cannot be said to be an enemy to her own young, since she thus gives them more than parental protection. It is probable, also, that this open-

bellied crocodile is viviparous, and fosters her young that are prematurely excluded in this second womb, until they come to proper maturity.⁵

How long the crocodile lives we are not certainly informed: if we may believe Aristotle, it lives the age of a man: but the ancients so much amused themselves in inventing fables concerning this animal, that even truth from them is suspicious. What we know for certain from the ancients is, that among the various animals that were produced to fight in the amphitheatre at Rome, the combat of the crocodile was not wanting.⁶ Marcus Scaurus produced them living in his unrivalled exhibitions; and the Romans considered him as their best citizen, because he furnished them with the most expensive entertainments. But entertainment at that corrupt time was their only occupation.

⁵ What the author means here by the open-bellied crocodile, we are at a loss to make out: but it is certain that not one of the lizard tribe have any thing like an abdominal pouch for the safety of their young.—Ed.

⁶ Plin. lib. viii. c. 26.

SUPPLEMENTARY NOTE.

The principal distinction betwixt the alligator and the crocodile is, that the former has its head, and part of the neck, more smooth than the other; and that the snout is considerably more wide and flat, as well as more rounded at the extremity. The size of a full-grown alligator is never more than eighteen feet in length; whereas the crocodile grows to twenty-five feet. Curwen has given the following distinguishing characters of the crocodile and alligator or cayman. The crocodile has an oblong snout, the upper jaw of which is sloped on each side for the reception of the teeth of the lower. The hind feet are completely palmated. The alligator has an obtuse mouth, the upper jaw receiving the fourth tooth of the lower, in a particular cavity which conceals it. The hind feet of this animal are semi-palmated.

The *Gigantic Crocodile* is a species different from the above two animals: its specific distinction is the jaws long, round, and subcylindric; with sixty teeth in the upper jaw, and fifty-eight in the lower: they are very sharp. Its ears are longer than the orbits, and without a flap; its snout altogether is nearly three times as long as the head; nape with six mamillary scales. The crocodile has forty teeth in the upper jaw, and thirty-eight in the lower.

The Egyptian crocodiles inhabit the Nile, the Senegal, and in all probability most of the other African rivers. At the present day it is found in the Nile, only towards the region of Upper Egypt, where it is extremely hot, and where this animal never falls into a lethargic state. Formerly, when it was wont to descend the branches of the river which water the Delta, it used to pass the four winter months in caverns, and without food. Of this fact we are informed by Pliny and other ancient naturalists. According to the relations of Hasselquist, and many other travellers, the crocodile of the Nile must be the largest animal of its kind. In Upper Egypt, these animals have been found thirty feet and more in length. The ancients pretend to have seen some of them six and twenty cubits in length, but this is probably nothing but exaggeration. These crocodiles have a strong odour of musk, which they even communicate to the waters, which they frequent. The negroes, notwithstanding this, use their flesh as food.

as did likewise the ancient inhabitants of Elphantina, according to the testimony of Herodotus. Moore informs us that among several African nations the eggs are esteemed the highest possible delicacy. They are used as food both in Egypt and the East Indies, as those of the cayman are in Florida and the other parts of America. It would seem that other species inhabit the Nile as well as this of which we are now speaking, and that at least one variety of the common crocodile is to be found in that river. M. Geoffroy St. Hilaire found a head of this embalmed in the caverns of Thebes. It is a little flatter and more elongated than that of the common crocodile. The old Egyptians entertained a superstitious veneration for the crocodile. At Memphis the sacred individual was reared with the greatest care, and nourished with abundant food. Sacrifices and offerings were presented to him; he was adorned with trinkets, and lodged in a lake or basin in the midst of the temple: thus treated, the crocodile lost its ferocity, and became so tame as to be led about in religious processions and ceremonies. In that country, so vaunted for wisdom, persons have been known sufficiently foolish and infatuated, as to rejoice when any of their children were devoured by the crocodile. But in some districts of Egypt, these animals were held in abhorrence, and hunted and killed, also through a sentiment of religion; because they believed that Typhon, the murderer of Osiris and the genius of evil, had transformed himself into a crocodile. In the year 58 before Christ, the edile Scaurus exhibited at Rome five crocodiles of the Nile, and subsequently the Emperor Augustus had the Flavianian circus filled with water, and exhibited there to the people thirty-six crocodiles, which were killed by an equal number of men, who were habituated to fight with these animals. In 1681, a living crocodile was brought to the menagerie of Versailles, and within some years many young individuals have been seen in Paris.

The *Double-crested crocodile* is the most common species in all the rivers which lead to the Indian ocean. It is found in Java. It is also to be met with in the rivers of Corea, and even in China.

The *Crocodile of St. Domingo* was first published as a distinct species by M. Geoffroy St. Hilaire, or an individual sent to the Museum of Paris by General Rochambeau. These crocodiles cannot eat in the water without running the risk of being suffocated. They dig holes in the bed of rivers, to drag in, and drown their victims, which they suffer to rot.

The tribe of the *CAYMANS*, as far as it is known at present, is confined to the continent of America. But the word *Cayman* is generally employed by all the European colonists to designate the crocodiles which are most common around their habitations. Thus the cayman of St. Domingo is a true crocodile. Authors are but little agreed on the origin of this name. The slaves, on their arrival from Africa, on sight of a crocodile, give it immediately the name of cayman. It would appear from this, that it was the negroes who spread this name throughout America, where it is employed even in Mexico.

The *Pike-muzzled Cayman* (*Crocodilus Lucius*) inhabits North America. It proceeds pretty far towards the north. It ascends the Mississippi, as far as the Red River. These reptiles, in Carolina, conceal themselves in marshy places covered with woods, and live there in the midst of carnage. They spring upon domestic animals such as pigs, sheep, and oxen, that are imprudent enough to penetrate into these vast solitudes, seize them with their powerful jaws, and drag them down to the bottom of the waters, where they are speedily devoured.

The *Spectacled Cayman* (*Crocodilus Sclerops*) grows to a very considerable size. It inhabits South America, and is very common at Cayenne, and throughout

all Guiana. In the great river of the environs of Surinam, some of these caymans have been seen, that attained to the length of twenty, and even twenty-four feet. The negroes sometimes eat their flesh, although it has a fetid and musky odour. Stedman assures us that they will not attack a man, as long as he remains in motion in the water. On land they do not possess one half of the swiftness of a man, and but seldom attack him there, unless he approaches their eggs. These they defend with remarkable courage. Schomburg, in his work on the fishes of Guiana, says: "Although abundance of fish, during certain seasons, prevails in the rivers of the interior, the cayman is nevertheless the most covetous of all animals, and envies every other successful fisher. This he gives to understand, particularly by angry growls, if the line with the captive is drawn in, and his attempts to intercept the captured fish before it be drawn on the land should have proved unsuccessful. While we were encamped at the mouth of the river Rewa, or Roiwa, during our last expedition, the afternoon of the 21st October had passed under thunder and rain: but at the approach of night, nature lulled herself to rest, and only the droppings from the leaves told of the former storm. I was lying sleepless in my hammock, and I watched two Indians who had their lines out to entrap some hungry fish. A killbaggie, lured away by the tempting bait, had snapped at it; and the fisherman, acquainted by the stress on his line of his success, drew the unwilling fish towards the canoe, when the roar of a cayman awoke the echo of the woods, and rushing towards the canoe with all its might, he recaptured the fish, as the astonished Indians were just on the point of drawing it in, and with it went the hook and a great part of the line. At our second night's camp, after we had entered the river Rupununi, the Indians were likewise fishing, and whenever a fish was caught and drawn towards the canoe, the caymans commenced such a roar that it baffled description. We distinctly heard that there were three; first one commenced when the fish that was drawn in began to struggle, and another answered him, until the noise was so great that the Indians, as if in self-defence, and to intimidate the approaching monsters, set up a shout themselves. Indeed, the roaring of the cayman is so strong, that in the still hour of night it may be heard a mile off—and there is something awful and indescribable in it: it is not the tiger's growl, the bull's bellowing, the lion's roar—it is different from all, and really terrific, when that sound bursts suddenly upon the ear. I might compare it to the snorting of a frightened horse, if the strength of that snort could be increased ten—no, twenty-fold in effect."

The *Cayman with onseous eyelids* (*Palpebrosus*) certainly inhabits Cayenne, and is a very distinct species. But little is known of its habits.

The sub-family of the *GAVIALS* have been observed only in the hottest countries of the ancient world. As yet we know but of two species of this subgenus, if indeed there be so many. The first is the *Great Gavial* (*C. Longirostris*). This gavial inhabits the Ganges, and probably some of the neighbouring rivers, such as the Burampooter. It feeds only on fish, and though it arrives to a gigantic size, it is not dangerous to man.

As for the *Little Gavial* (*Tenuirostris*), we neither know to what size it may arrive, nor what country it inhabits, though it is suspected that it belongs to Africa.

MONITORS are easily to be distinguished from the crocodiles, which have the hinder feet palmated; from the dragons, which have angular plates upon the head; from the safe-guave, which have denticulated or serrated teeth; from the lizards and ameivas, which have the tail round; from the lophyri and

basilisks, which have a crest upon the back; and in short from all the other saurian reptiles.

The *Tupinambis*, or *Monitor* of Congo, is about five or six feet in length, and devours all kinds of smaller reptiles and insects, which circumstance causes it to be held in high respect by the negroes, under the roofs of whose cottages it frequently pursues its prey.

The *Land Monitor* of Egypt is common in the deserts which border upon that country. The jugglers of Cairo employ it in the performance of tricks, after having drawn its teeth. It is the land crocodile mentioned by Herodotus.

The *Variegated Tupinambis* of New Holland is of a tint generally black, but varied with spots and stripes of different forms. There are several transverse ranges of round and yellow spots on the limbs, and the tail is covered, throughout its entire length, with numerous annulated bands alternately black and yellow. This reptile conceals itself at the bottom of the waters when it is pursued. Its total length is about three feet and a half.

The *Monitor Crocodilinus* of Merren, (*Ada* of Gray,) inhabits many regions of South America, Guiana more especially, where it is however comparatively rare. It resembles the crocodile as to form, but bears no similarity to it in its habits. It swims with some degree of difficulty, runs with tolerable swiftness, and climbs trees with great nimbleness and dexterity. It sometimes preys upon such animals as it meets with in the woods, frequents the inundated savannahs and marshy soils of its native regions, though it more generally sojourns on land and in the sun, than in the water. There is very considerable difficulty in taking it, because it conceals itself in burrows, and bites desperately. Its flesh is eaten, and reported to be no small delicacy. Its eggs are also in high estimation at Cayenne, and each female usually lays several dozens of them. The length of this reptile is generally from four to six feet.

CHAP. III.

OF THE SALAMANDER.

THE ancients have described a lizard that is bred from heat, that lives in the flames, and feeds upon fire as its proper nourishment. As they saw every other element, the air, the earth, and water, inhabited, fancy was set to work to find or make an inhabitant in fire; and thus to people every part of nature. It will be needless to say that there is no such animal existing; and that of all others, the modern salamander has the smallest affinity to such an abode.

Whether the animal that now goes by the name of the Salamander be the same with that described by Pliny, is a doubt with me; but this is not a place for the discussion. It is sufficient to observe, that the modern salamander is an animal of the lizard kind, and under this name is comprehended a large tribe that all go by the same name. There have been not less than seven sorts of this animal described by Seba; and to have some idea of the peculiarity of their figure, if we suppose the tail of a lizard applied to the body of a frog, we shall not be far from precision. The

common lizard is long, small, and taper; the salamander, like the frog, has its eyes towards the back of the head; like the frog, its snout is round, and not pointed, and its belly thick and swollen. The claws of its toes are short and feeble; its skin rough; and the tongue, unlike that of the smallest of the lizard kind, in which it is long and forked, is short, and adhering to the under jaw.

But it is not in figure that this animal chiefly differs from the rest of the lizard tribe; for it seems to differ in nature and conformation. In nature it is unlike, being a heavy torpid animal; whereas the lizard tribe are active, restless, and ever in motion; in conformation it is unlike, as the salamander is produced alive from the body of its parent, and is completely formed the moment of its exclusion. It differs from them also in its general reputation of being venomous: however, no trials that have been hitherto made seem to confirm the truth of the report.

Not only this, but many others of the lizard tribe, are said to have venom; but it were to be wished that mankind, for their own happiness, would examine into the foundation of this reproach. By that means many of them, that are now shunned and detested, might be found inoffensive; their figure, instead of exciting either horror or disgust, would then only tend to animate the general scene of nature; and speculation might examine their manners in confidence and security. Certain it is, that all of the lizard kind, with which we are acquainted in this country, are perfectly harmless; and it is equally true that, for a long time, till our prejudices were removed, we considered not only the Newt, but the Snake and the Blind-worm, as fraught with the most destructive poison. At present we have got over these prejudices; and, it is probable, that if other nations made the same efforts for information, it would be found, that the malignity of most, if not all, of the lizard tribe, was only in the imagination.

With respect to the salamander, the whole tribe, from the Moron to the Gekko, are said to be venomous to the last degree; yet, when experiments have been tried, no arts, no provocations, could excite these animals to the rage of biting. They seem timid and inoffensive, only living upon worms and insects; quite destitute of fangs, like the viper, their teeth are so very small that they are hardly able to inflict a wound. But as the teeth are thus incapable of offending, the people of the countries where they are found have recourse to a venomous slaver, which, they suppose, issues from the animal's mouth; they also tell us of a venom issuing from the claws: even Linnæus seems to acknowledge the fact; but thinks it a probable supposition that this venom may proceed from their urine.

Of all animals, the Gekko is the most notorious for its powers of mischief; yet we are told by those who load it with that calumny, that it is

very friendly to man, and though supplied with the most deadly virulence, is yet never known to bite. It would be absurd in us, without experience, to pronounce upon the noxious or inoffensive qualities of animals, yet it is probable, from an inspection of the teeth of lizards, and from their inoffensive qualities in Europe, that the gekko has been unjustly accused; and that its serpent-like figure has involved it in one common reproach with serpents.¹

The salamander best known in Europe, is from eight to eleven inches long, usually black, spotted with yellow; and, when taken in the hand, feeling cold to a great degree.—There are several kinds. Our Black Water-Newt is reckoned among the number. The idle report of its being inconsumable in fire, has caused many of these poor animals to be burnt; but we cannot say as philosophical martyrs, since scarcely any philosopher could think it necessary to make the experiment. When thrown into the fire, the animal is seen to burst with the heat of its situation, and to eject its fluids. We are gravely told, in the Philosophical Transactions, that this is a method the animal takes to extinguish the flames!

When examined internally, the salamander exhibits little difference from other animals of the lizard kind. It is furnished with lungs that sometimes serve for the offices of breathing; with a heart that has its communications open, so that the animal cannot easily be drowned. The ovary in the female is double the size of what it is in others of this tribe; and the male is furnished with four testiculi instead of two. But what deserves particular notice is the manner of this animal's bringing forth its young alive.² "The salamander," says my author, "begins to show itself in spring, and chiefly during heavy rains. When the warm weather returns, it disappears; and never leaves its hole, during either great heats or severe colds, both which it equally fears. When taken in the hand, it appears like

a lump of ice; it consequently loves the shade, and is found at the feet of old trees surrounded with brushwood at the bottom. It is fond of running along new ploughed grounds; probably to seek for worms, which are its ordinary food. One of these," continues my author, "I took alive some years ago in a ditch that had been lately made. I laid it at the foot of the stairs upon coming home, and there it disgorged from the throat a worm three inches long, that lived for an hour after, though wounded as I suppose by the teeth of the animal. I afterwards cut up another of these lizards, and saw not less than fifty young ones, resembling the parent, come from its womb, all alive, and actively running about the room." It were to be wished that the author had used another word beside that of *worm*; as we now are in doubt whether he means a real worm, or a young animal of the lizard species; had he been more explicit, and had it appeared that it was a real young lizard, which I take to be his meaning, we might here see a wonder of nature brought to the proof, which many have asserted, and many have thought proper to deny: I mean the refuge which the young of the shark, the lizard, and the viper kinds, are said to take, by running down the throat of the parent, and there finding a temporary security. The fact, indeed, seems a little extraordinary; and yet it is so frequently attested by some, and even believed by others, whose authority is respectable, among the number of whom we find Mr. Pennant, that the argument of strangeness must give way to the weight of authority.

However this be, there is no doubt of the animal's being viviparous, and producing about fifty at a time. They come from the parent in full perfection, and quickly leave her to shift for themselves. These animals, in the lower ranks of nature, want scarcely any help when excluded; they soon complete the little circle of their education; and in a day or two are capable of practising all the arts of subsistence and evasion practised by their kind.

They are all amphibious, or at least are found capable of subsisting in either element, when placed there: if those taken from land are put into water, they continue there in seeming health; and, on the contrary, those taken from the water will live upon land. In water, however, they exhibit a greater variety in their appearance; and what is equally wonderful with the rest of their history, during the whole spring and summer, this water-lizard changes its skin every fourth or fifth day; and during the winter every fifteen days. This operation they perform by means of the mouth and the claws; and it seems a work of no small difficulty and pain. The cast skins are frequently seen floating on the surface of the water: they are sometimes seen also with a part of their old skin still sticking to one of their limbs, which they have not been able to get rid of; and thus, like a man with a boot half

¹ The *Lacerta Gekko*, a native of the Island of Java, is in the habit of coming out of an evening from the roofs of the houses, and walking down the smooth, hard, polished chunam walls in search of flies that settle upon them, and then of running up again. Sir Joseph Banks, while at Batavia, used to catch this animal by standing close to the wall with a long flattened pole, which being made suddenly to scrape the surface, knocked it down. Sir Everard Home procured a specimen of a very large size, which enabled him to ascertain the peculiar mechanism by which the feet of this animal keep their hold of a smooth hard perpendicular wall, and carry up so large a weight as that of its own body. He found that the foot of this lizard was so constructed as to enable it to produce a number of small concavities which act like so many cupping glasses, and atmospheric pressure retains them in this position. It appears that the fly's foot possesses concave surfaces capable of acting in the same manner as those of the *Lacerta Gekko*, and therefore its progressive motion against gravity is effected by the same means.—Ed.

² *Acta Hafniensia*, ann. 1676. Observ. 11. *Mémoires de l'Académie Royale des Sciences*, tom. iii. part 3, p. 80.

drawn, in some measure crippled with their own spoils. This also often corrupts, and the leg drops off; but the animal does not seem to feel the want of it, for the loss of a limb to all the lizard kind is but a trifling calamity. They can live several hours even after the loss of their head: and for some time under dissection, all the parts of this animal seem to retain life: but the tail is the part that longest retains its motion. Salt seems to be much more efficacious in destroying these animals than the knife; for upon being sprinkled with it, the whole body emits a viscous liquor, and the lizard dies in three minutes, in great agonies.

The whole of the lizard kind are also tenacious of life in another respect, and the salamander among the number. They sustain the want of food in a surprising manner. One of them, brought from the Indies, lived nine months, without any other food than what it received from licking a piece of earth on which it was brought over;³ another was kept by Seba in an empty vial for six months, without any nourishment; and Rhedi talks of a large one, brought from Africa, that lived for eight months, without taking any nourishment whatever. Indeed, as many of this kind, both salamanders and lizards, are torpid, or nearly so, during the winter, the loss of their appetite for so long a time is the less surprising.

³ Phil. Trans. ann. 1661. N. 21, art. 7.

NOTE A.—*The Salamanders.*

The terrestrial salamander is found in France, in Germany, and even sometimes in very high latitudes. It is also found in the southern parts of Europe. It takes up its abode in the humid earth, in the tufted woods of high mountains, in ditches and shady places, under stones and the roots of trees, in hedges, by the banks of streams, in subterraneous caverns, and ruined buildings. Though generally feared, it is by no means dangerous. The milky fluid which exudes from its skin, and which it sometimes shoots to the distance of several inches, though nauseous, acrid, and, according to Gesner, even depilatory, is fatal only to very small animals. This humour, however, doubtless is the cause of a general proscription of the salamander. According to Pliny, by infecting with its poison all the vegetables of a vast extent of territory, this reptile could produce death to entire nations! It is almost unnecessary to repeat now, that there is not the slightest foundation for the story of this animal being able to resist the action of fire. If the salamander be struck, it raises its tail, and seems affected by catalepsy. It seldom quits the hole where it makes its habitual residence. It passes its life in general under ground. During summer it dreads the heat of the sun, and seldom ventures forth, except in rainy seasons, or by night. Its walk is slow and heavy. It is stupid, and totally destitute of courage, never braving danger, as has been pretended. It is true, indeed, that it does not seem to perceive the approach of peril, against which it advances blindly, without deviating from its route: but this is mere stupidity, not courage. It lives on flies, worms, young snails, scarabei, earth-worms, &c. It also eats humus. Though very tenacious of life, it falls rapidly into convulsions, if it be steep-

ed in vinegar or sprinkled with salt. The perceptive powers of this reptile seem to be remarkably dull. It shows no dread of the presence of man, or of animals stronger than itself. Other animals, however, seem to have an instinctive horror of it. Its bite is perfectly harmless, though Matthioli has declared it to be equally fatal with that of the viper—an atrocious absurdity. The salamander utters no cry. On being thrown into the water, it tries immediately to get out again, and comes every moment to the surface to respire. When on the ground, it frequently rolls itself into a spiral. It appears, according to the authority of Gesner, that in countries too much elevated in latitude, the salamanders pass the winter in a sort of burrow under ground, where numbers of them are to be found, assembled, and intertwined together. The salamander, like the viper, is oviparous. The eggs open in the oviducts, and the young come forth fully formed. The latter, whose tail is compressed vertically, are folded in two, to the number of from eight to twenty in each of the five oviducts, where they are nourished by a peculiar fluid, and from which they do not come until they have gone through all their metamorphoses, that is, have lost their gills, and acquired their feet. Then they are deposited near marshes, to the number of forty, and even sometimes fifty at a time. Their colour is a uniform black. Nothing is more erroneous than the opinion that the terrestrial salamander is destitute of sex, and that each individual is capable of self-reproduction.

Aquatic salamanders are externally distinguished from the land salamanders by having a compressed, not a rounded tail; but in all the other main points of anatomical conformation they agree. They have been rendered celebrated by the experiments of Spallanzani on their astonishing faculty of reproducing parts which have been removed, and those, too, with all their peculiar bones, muscles, vessels, &c. They have been caught in the ice, and remained there a long time without perishing. The eggs are fecundated by the males in the water, and come forth in long chaplets. The young preserve their gills for a longer or shorter time, and the colours of these animals change according to age, sex, and season. When the organs of digestion have acquired the size necessary for the exercise of their functions, the curious spectator perceives in the little salamander, whose life hitherto has been purely organic or vegetative, the life of relation, or the animal life, to begin. At this epoch, the movements of the young animal are no longer automatic, or the result simply of its internal organization, but they are also the consequence of sensations which the surrounding objects cause it to experience. In truth, it now avoids and removes from those objects from which it dreads inconvenience or pain, and approaches those from which it hopes to receive advantage and pleasure. We see it, at this period, watch the minuter insects which it perceives swimming in the water, direct its little snout towards them, pursue them with address, and dart upon them with surprising agility. When it is keenly pressed by hunger, it even attacks its comrades, and seeks its nourishment by devouring their gills and tail. Recently, at Auchtertool, a village about four miles from Kirkcaldy in Scotland, while dressing a heavy barley millstone from a large block, after cutting away a part, found a lizard of this species imbedded in the stone. It was about an inch and a quarter long, of a brownish yellow colour, and had a round head with bright sparkling projecting eyes. When first exposed it was apparently dead; but after being about five minutes exposed to the air, it showed signs of life. It soon became lively, and ran about with much celerity; and about half-an-hour after the discovery, was brushed off the stone, and killed. When found, it

was coiled up in a round cavity of its own form, being an exact impression of the animal. There were about fourteen feet of earth above the rock, and the block in which the lizard was found was seven or eight feet in the rock; so that the whole depth of the animal from the surface was twenty-one or twenty-two feet. The stone had no fissure, was quite hard, and one of the best which is got from the quarry of Cullaloe; the stone is reckoned one of the hardest in Scotland.

NOTE B.—*The Proteus Anguinus.*

This animal has much excited the curiosity of zoologists, and many points in its natural history and anatomy still remain undecided. It appears that the first knowledge of this animal was communicated to the public by Dr. Laurence, in 1768. Cuvier first discovered the female, and established on a solid foundation that the proteus was not a larva, as many had supposed, but a perfect animal; an opinion now generally followed, and confirmed by the recent observations of Rudolphi.

The *Proteus anguinus* lives and multiplies in the water of certain subterranean caverns of Carniola. The province in which these caverns occur is divided by a chain of mountains of secondary or transition limestone, on which rest many hills of posterior formation. Both in the mountains and hills are numerous caverns, and subterranean passages stretching in various directions. These caverns communicate with one another, so that the water first collected in those at a higher level, falls down and circulates through subterranean channels, till it settles in the lower caverns, some of which are of vast size and depth. Two of the most remarkable of these caverns are situated near Adelsberg, a village lying midway between Triest and Lubiana. One of them, called the cavern of Adelsberg, is close to the village, and the other, named the cavern of Maddlena, is only a few miles distant. It is in this last that the peasants go to fish for the protei.

Configliachi and Rusconi had no opportunity of becoming acquainted with these extraordinary animals in their native caverns; but they give a very interesting and detailed account of the habits of several which they kept in vessels within doors for more than two years. None of those kept by them exceeded twelve inches in length, and the smallest they have heard of was only four. It is, however, probable that fourteen inches is their full size. Schreibers had one, in 1801, which measured thirteen inches. The Archduke John of Austria, kept in a subterranean grotto, constructed for the purpose, several of these animals, one of which lived eight years, and acquired a size greater than ordinary.

When viewed alive and in water, the body of the proteus appears at first of a cylindrical form, but when more attentively surveyed, it is seen to be somewhat flattened on the sides, especially towards the tail, which, beyond the lower limbs, is reduced at length to the shape of a spatula. The back and head of the animal are of a whitish-red colour, which, on the sides of the tail, inclines to violet. The belly, on the contrary, is white, though even there in the region of the liver, it has a bluish cast, like that of the human veins, seen through a very fine and delicate skin. From whitish-red, the skin passes by degrees to violet; so that to preserve the natural colour, it is necessary to keep the animal always in obscurity. The skin of this reptile, like that of eels, is everywhere besmeared with a violet viscid mucus; and when viewed with a lens, it is observed to be studded with minute reddish spots, and with innumerable pores. By reason of this mucosity, the proteus easily slides out of the hand, and while

alive, is with difficulty fixed down to any substance for the purpose of dissection.

The mouth differs from that of other reptiles. The upper lip, after covering the teeth, is continued a little downward over the under one in front; and, on the other hand, the under lip is continued upward over the upper one on the sides of the mouth.

When a proteus that has been kept some time in darkness is observed with caution, he is always found to be resting quietly at the bottom of the vessel. But if the vessel be quickly uncovered, he suddenly begins to move, is much agitated, and seeks always that part of the vessel which is darkest. If now that part of the vessel be exposed to the light, the animal again begins to move, and soon his gills assume a redder tint, and the rest of the body also becomes of a redder hue. In fact, the light gives pain, and the animal exerts itself to avoid it. His disposition to avoid light is the more remarkable, as the eyes of this animal are incredibly small, and so buried beneath the skin, that a person even apprized of their situation, must use great diligence to discover them.

This reptile feeds on worms, small bivalves, and snails. In this he resembles the salamander, but he bears fasting much better, being able to live two years and even more without aliment. When taken from his natural habitation and exposed to the vicissitudes of the season, like other perfect reptiles he hides himself during the winter, is inert, and refuses food. The proteus does not live long, if he is taken out of the water. When he becomes dry, he dies more or less quickly, according as the season is more or less warm, being less able to sustain life under such circumstances than fishes. But if the proteus die more speedily when out of water; in water, on the contrary, he lives better than fishes, since, *ceteris paribus*, he has not such frequent need of a renewal of the water as fishes have. When placed in a small vessel, at the temperature of 65° 5', the proteus, like fishes, rises at times to the surface to take in air by the mouth. The necessity of inspiring air from time to time, is more or less urgent, according as the water is more or less impure; and it has a more direct relation to the temperature than to the quantity of water.

Configliachi and Rusconi enclosed a proteus in a box perforated with holes, which was then sunk in a large lake, and kept for three months and a half beneath the surface. At the end of this time, on examining the box, the animal was found extremely lively, which clearly showed, that submersion in water for a long period had in no way injured its vital economy. The temperature of the water for a long time varied little from 66°. For four months together two protei have been kept in a small vessel of water of the temperature of from 43° to 45° 5', and have lived very well, although the water had not been once changed.

With regard to the faculties of sense, those of hearing and seeing appear to be very weak; but those of touch and of smell, particularly the latter, exquisitely acute. When some small fishes were put into the vessel containing a proteus, it was amusing to see the animal direct his snout towards his prey, though he could not possibly see it, and afterwards seize it with the greatest celerity when a fish passed near him. But it may be asked, if the sense of sight be so weak, why is it that this animal so anxiously avoids the light? It is probable that the constant desire of obscurity arises from the painful action of light, not on the eye but on the skin. From the experiments, however, of Rudolphi, it appears that this animal may, in time, be brought to bear the presence of light. Rusconi is of opinion, that the proteus is a perfect reptile, differing from all other reptiles, in not having, like them, a simple respiration, but resembling fishes, in respiring by means of branchiæ or gills

CHAP. IV.

OF THE CAMELEON, THE IGUANA, AND LIZARDS OF
DIFFERENT KINDS.

It were to be wished that animals could be so classed, that by the very mentioning their rank, we should receive some insight into their history. This I have endeavoured in most instances; but in the present chapter all method is totally unserviceable. Here distribution gives no general ideas: for some of the animals to be here mentioned produce by eggs, some by spawn, and some are viviparous. The peculiar manner of propagating in each, is very indistinctly known. The Iguana and the Cameleon, we know, bring forth eggs; some others also produce in the same manner; but of the rest, which naturalists make amount to about fifty, we have but very indistinct information.

In the former divisions of this tribe, we had to observe upon animals, formidable from their size, or disgusting from their frog-like head and appearance; in the present division, all the animals are either beautiful to the eye, or grateful to the appetite. The lizards, properly so called, are beautifully painted and mottled; their frolicsome agility is amusing to those who are familiar with their appearance; and the great affection which some of them show to man, should, in some measure, be repaid with kindness. Others, such as the Iguana, though not possessed of beauty, are very serviceable, furnishing one of the most luxurious feasts the tropical climates can boast of. Those treated of before were objects of curiosity, because they were apparently objects of danger: most of these here mentioned have either use or beauty to engage us.

Directly descending from the crocodile, we find the Cordyle, the Tockay, and the Tejuguacu, all growing less in order, as I have named them. These fill up the chasm to be found between the crocodile and the African iguana.

The Iguana, which deserves our notice, is about five feet long, and the body about as thick as one's thigh: the skin is covered with small scales, like those of a serpent; and the back is furnished with a row of prickles, that stand up, like the teeth of a saw: the eyes seem to be but half opened, except when the animal is angry, and then they appear large and sparkling: both the jaws are full of very sharp teeth, and the bite is dangerous, though not venomous, for it never lets loose till it is killed. The male has a skin hanging under his throat, which reaches down to his breast; and, when displeased, he puffs it up like a bladder: he is one-third larger and stronger than the female; though the strength of either avails them little towards their defence. The males are ash-coloured, and the females are green.

The flesh of these may be considered as the greatest delicacy of Africa and America; and the sportsmen of those climates go out to hunt the iguana, as we do in pursuit of the pheasant or the hare. In the beginning of the season, when the great floods of the tropical climates are passed away, and vegetation starts into universal verdure, the sportsmen are seen, with a noose and a stick, wandering along the sides of the rivers to take the iguana. The animal, though apparently formed for combat, is the most harmless creature of all the forest: it lives among the trees, or sports in the water, without ever offering to offend; there, having fed upon the flowers of the mahot, and the leaves of the mapou, that grow along the banks of the stream, it goes to repose upon the branches of the trees that hang over the water. Upon the land the animal is swift of foot; but when once in possession of a tree, it seems conscious of the security of its situation, and never offers to stir. There the sportsman easily finds it, and as easily fastens his noose round its neck: if the head be placed in such a manner that the noose cannot readily be fastened, by hitting the animal a blow on the nose with the stick, it lifts the head, and offers it in some measure to the noose. In this manner, and also by the tail, the iguana is dragged from the trees, and killed by repeated blows on the head.¹

The Cameleon is a very different animal; and as the iguana satisfies the appetites of the epicure, this is rather the feast of the philosopher. Like the crocodile, this animal proceeds from an egg; and it also nearly resembles that formidable creature in form: but it differs widely in its size and appetites; being not above eleven inches long, and delighting to sit upon trees, being afraid of serpents, from which it is unable to escape on the ground.

The head of a large cameleon is almost two inches long; and from thence to the beginning of the tail, four and a half: the tail is five inches long, and the feet two and a half: the thickness of the body is different at different times; for sometimes, from the back to the belly, it is two inches, and sometimes but one; for it can blow itself up, and contract itself at pleasure. This swelling and contraction is not only of the back and belly, but of the legs and tail.

These different tumours do not proceed from a dilatation of the breast in breathing, which rises and falls by turns; but are very irregular, and seem adopted merely from caprice. The cameleon is often seen, as it were, blown up for two hours together; and then it continues growing less and less insensibly; for the dilatation is always more quick and visible than the contraction. In this last state the animal appears extremely lean; the spine of the back seems sharp, and all the ribs may be counted; likewise the

¹ See Supplementary Note A, p. 375.

tendons of the legs and arms may be seen very distinctly.

This method of puffing itself up, is similar to that in pigeons, whose crops are sometimes greatly distended with air. Theameleon has a power of driving the air it breathes over every part of the body: however, it only gets between the skin and the muscles; for the muscles themselves are never swollen. The skin is very cold to the touch; and though the animal seems so lean, there is no feeling the beating of the heart. The surface of the skin is unequal, and has a grain not unlike shagreen, but very soft, because each eminence is as smooth as if it were polished. Some of these little protuberances are as large as a pin's head, on the arms, legs, belly, and tail; but on the shoulders and head they are of an oval figure, and a little larger: those under the throat are ranged in the form of a chaplet, from the lower lip to the breast. The colour of all these eminences, when theameleon is at rest in a shady place, is of a bluish gray, and the space between is of a pale red and yellow.

But when the animal is removed into the sun, then comes the wonderful part of its history. At first it appears to suffer no change of colour, its grayish spots still continuing the same: but the whole surface soon seems to imbibe the rays of light; and the simple colouring of the body changes into a variety of beautiful hues. Wherever the light comes upon the body, it is of a tawny brown; but that part of the skin on which the sun does not shine, changes into several brighter colours, pale yellow or vivid crimson; which forms spots of the size of half one's finger: some of these descend from the spine half way down the back; and others appear on the sides, arms, and tail. When the sun has done shining, the original gray colour returns by degrees, and covers all the body. Sometimes the animal becomes all over spotted with brown spots, of a greenish cast. When it is wrapt up in a white linen cloth for two or three minutes, the natural colour becomes much lighter; but not quite white, as some authors have pretended: however, from hence it must not be concluded that theameleon assumes the colour of the objects which it approaches; this is entirely an error, and probably has taken its rise from the continual changes it appears to undergo.²

Le Bruyn, in his Voyage to the Levant, has given us a very ample description of theameleon. During his stay at Smyrna, he bought several of this kind; and to try how long they could live, kept four of them in a cage, permitting them at times to run about the house. The fresh sea-breeze seemed to give them most spirits and vivacity; they opened their mouths to take it in; he never perceived that they eat anything, except now and then a fly, which they took half-an-hour to swallow: he observed their colour of-

ten to change, three or four times successively, without being able to find out any cause for such alterations; their common colour he found to be gray, or rather a pale mouse colour; but its most frequent changes were into a beautiful green, spotted with yellow; sometimes the animal was marked all over with a dark brown; and this often changed into a lighter brown: some colours, however, it never assumed; and contrary to what was said above, he found red to be among the number.

Though our traveller took the utmost care, he was unable to preserve any of them alive above five months; and many of them died in four. When theameleon changes place, and attempts to descend from an eminence, it moves with the utmost precaution, advancing one leg very deliberately before the other, still securing itself by holding whatever it can grasp by the tail. It seldom opens its mouth, except for fresh air; and when that is supplied, discovers its satisfaction by its motions, and the frequent changes of its colour. The tongue is sometimes darted out after its prey, which is flies; and this is as long as the whole body. The eyes are remarkably little, though they stand out of the head; they have a single eyelid, like a cap with a hole in the middle, through which the sight of the eye appears, which is of a shining brown; and round it there is a little circle of a gold colour: but the most extraordinary part of their conformation is, that the animal often moves one eye, when the other is entirely at rest: nay, sometimes one eye will seem to look directly forward, while the other looks backward; and one will look upward, while the other regards the earth.

To this class of lizards, we may refer the dragon, a most terrible animal, but most probably not of Nature's formation. Of this death-dealing creature all people have read; and the most barbarous countries, to this day, paint it to the imagination in all its terrors; and fear to meet it in every forest. It is not enough that nature has furnished those countries with poisons of various malignity; with serpents forty feet long; with elephants, lions, and tigers; to make their situation really dangerous, the capricious imagination is set at work to call up new terrors; and scarce a savage is found that does not talk of winged serpents of immoderate length, flying away with the camel or rhinoceros, or destroying mankind by a single glare. Happily, however, such ravagers are nowhere found to exist at present; and the whole race of dragons is dwindled down to the Flying lizard, a little harmless creature, that only preys upon insects, and even seems to embellish the forest with its beauty.

The Flying lizard of Java perches upon fruit-trees, and feeds upon flies, ants, butterflies, and other small insects. It is a very harmless creature, and does no mischief in any respect. Gentil, in his voyage round the world, affirms, that he has seen these lizards at the island of Java in

² See Supplementary Note B, p. 376.

the East Indies. He observed they flew very swiftly from tree to tree; and having killed one, he could not but admire the skin, which was painted with several beautiful colours; it was a foot in length, and had four paws, like the common lizards; but its head was flat, and had a small hole in the middle; the wings were very thin, and resembled those of a flying fish. About the neck were a sort of wattles, not unlike those of cocks, which gave it no disagreeable appearance. He intended to have preserved it, in order to bring it into Europe; but it was corrupted by the heat, before the close of the day: however, they have since been brought into England, and are now common enough in the cabinets of the curious.

The last animal of the lizard kind that I shall mention, is the Chalcidian lizard of Aldrovandus, very improperly called the *Seps* by modern historians. This animal seems to make the shade that separates the lizard from the serpent race. It has four legs, like the lizard; but so short, as to be utterly unserviceable in walking: it has a long slender body, like the serpent; and it is said to have the serpent's malignity also. The fore legs are very near the head; the hind legs are placed far backward; but before and behind they seem rather useless encumbrances than instruments serving to assist the animal in its motions, or in providing for its subsistence. These animals are found above three feet long, and thick in proportion, with a large head and pointed snout. The whole body is covered with scales; and the belly is white mixed with blue. It has four crooked teeth, as also a pointed tail, which, however, can inflict no wound. Whether the teeth be similar to the viper's fangs, we are not told; though Volateranus says, they are covered with a membrane; by which I am apt to think he means a venom bag, which is found at the root of teeth of all serpents that are poisonous. It is viviparous; fifteen young ones having been taken alive out of its belly. Upon the whole, it appears to bear a strong affinity to the viper; and, like that animal, its bite may be dangerous.

NOTE A.—The Genus *Iguana*.

The reptiles which most naturalists have hitherto regarded as belonging to the genus *iguana* are tolerably numerous; but modern naturalists, after having examined and compared them with more attention than their predecessors, have transferred many of them to the *agamæ*, and formed separate genera of the basilisk and the marble *iguana*.

The *Common American Iguana* is from four to five feet long. It is very common in all the warm parts of America, where it remains in the woods, at the environs of rivers, and sources of spring-water. It passes most part of its time on trees, sometimes going to the water, and living on fruits, grain, and leaves. Without being either venomous or dangerous, its bite is exceedingly painful; and when it is angry, the goitre which it has under its neck becomes distended and expanded. This reptile has great tenacity and endurance of life, and will resist the blows

of a stick or cudgel very well. Accordingly, it is usually hunted with the bow or the gun. The females are smaller than the males, but their colours are much more brilliant. They lay eggs in the sand, about as large as those of pigeons, but a little longer, and of equal thickness at both ends. The shell of these eggs is white, even, and soft. They are entirely filled by the yolk, and can hardly be said to have any albumen. They never harden by fire, but only become a little pasty. But their flavour is very agreeable, and they are constantly eaten in Surinam and Guiana. A single female will lay about six dozen. The flesh of the *iguana* is considered as delicious, and is in great estimation throughout all the warm parts of America. It is white and delicate. Many persons, however, consider it as unwholesome, especially for those who are infected with syphilis, some symptoms of which, such as pains in the bones, &c., it is supposed to aggravate or cause the return of. At Paramaribo, it is sold extremely dear, and highly thought of by epicures. Pison, and many other of the old travellers in America, have spoken in high terms of the virtues of the bezoar of the *iguana*, a kind of stone, found, say they, in the stomach or cranium of this reptile. But, at the present day, this substance is fallen into the most absolute disrepute among all medical practitioners.

The *Slate-coloured Iguana* is but three feet in length. It inhabits the same places as the former species, and may be merely a variety of it, in age or sex. Seba derives it from the island of Formosa.

The *Horned Iguana* of St. Domingo is about four feet long. It is frequently found in the hills of St. Domingo, between Artibonite and Ganaives. It lives on fruits, insects, and small birds, which it seizes with marvellous agility, and during the day it couches on trees and rocks to watch for its prey. During the night, and the entire season of the great heats, it retires into the hollows of rocks, or into the holes of old trees, and it passes about five or six months of the year there in a state of lethargy. This reptile is considered by the negroes as a delicious meat, and is accordingly sought after by them with great avidity. According to the report of the colonists, its flesh resembles in flavour that of the roebuck, and the maroon dogs make great slaughter among these reptiles. The colours of this *iguana* are not precisely known.

Some authors place here the *Iguana fasciata*. Its colour is deep blue, with transverse bands of a clearer tint. The goitre is moderate, and not denticulated. There is no large scale at the angle of the jaw. This *iguana* belongs to the island of Java. It may probably be the reptile which Bontius has named *cameleon*. It is also probable, that to this species must be referred the very large *iguanas* which are found at Batavia, and which are sometimes as thick as a man's thigh. In his voyage with Captain Cook, Sir Joseph Banks killed one of these, which was five feet in length.

Under the name of *Basilisk* is at present designated a genus of reptiles, of this saurian order, which exhibits many affinities with the *iguanas* and *monitors*. No animal, perhaps, has been the subject of so great a number of prejudices as the one now under consideration. The most ancient authors have spoken of the basilisk, as of a serpent which had the power of striking its victim dead by a single glance. Others have pretended that it could not exercise this faculty, unless it first perceived the object of its vengeance before it was itself perceived by it. It was also most absurdly imagined to proceed from the eggs of old cocks. Aldrovandus, and several other writers have given figures of it. They have represented it with eight feet, a crown on the head, and a hooked and recurved beak. Pliny assures us that the serpent named basilisk has a voice so terrible, that it strikes

terror into all other species, that it thus chases them from the spot which it inhabits, and of which it retains the sole and undisputed dominion. The name, indeed, of basilisk, *Basiliscus*, signifies royal. The fantastic forms, and fabulous properties thus attributed to an animal, which most probably never had any existence, rendered this name too celebrated for naturalists not to endeavour to apply it to another species, which accordingly they did. Seba has figured a species of lizard, whose head is surmounted with projecting lines, and the back furnished with a broad vertical crest, which extends as far as over the tail, and which that author believed to be intended for the purposes of flight. He has designated it under the name of basilisk, or dragon of America, a flying amphibious animal. This is the animal which has subsequently been described in all works of natural history under the name of basilisk.

NOTE B.—*The Cameleon and Lizards.*

Few animals have been more celebrated by natural historians than the *cameleon*, which has been said to possess the power of changing its colour at pleasure, and of assimilating it to that of any particular object or situation: this, however, must be received with very great limitations,—the change of colour which the animal exhibits varying in degree, according to the circumstances of health, temperature of the weather, and many other causes, and consisting chiefly in a sort of alteration of shades from the natural greenish or bluish gray of the skin into pale yellowish, with irregular spots or patches of dull red. It is also observed, that the natural or usual colour of *cameleons* varies very considerably, some being much darker than others; and it has even been seen approaching to a blackish tinge. An occasional change of colour is likewise observable, though in a less striking degree, in some other lizards. Mr. Barrow says, that “previously to the *cameleon*’s assuming a change of colour, it makes a long inspiration, the body swelling out to twice its usual size; and, as this inflation subsides, the change of colour gradually takes place. The only permanent marks are two small dark lines passing along the sides.” It seems that the causes of these different varieties are several: and first, the blood of the *cameleon* is of a violet blue, which colour it will preserve for some minutes on linen or on paper. In the second place, the different tubercles of the vessels are yellow, as well in their trunks as in their ramifications. The epidermis, or exterior skin, when separated from the other, is transparent, without any colour; and the second skin is yellow, as are all the little vessels that touch it. Hence it is probable that the change of colour depends upon the mixtures of blue and yellow, from which result different shades of green. Thus, when the animal, healthy and well fed, is provoked, its blood is carried in greater abundance from the heart towards the extremities; and, swelling the vessels that are spread over the skin, its blue colour subsides the yellow of the vessels, and produces a blue-green that is seen through the epidermis. When, on the contrary, the animal is impoverished and deprived of free air, the exterior vessels become more empty, their colour prevails, and the animal becomes of a yellow green, till it recovers its liberty, is well nourished, and without pain, when it regains the colour; this being the consequence of an equilibrium in the liquids, and of a due proportion of them in the vessels.

The *Variiegated lizard*, by far the largest in this division of the genus, sometimes exceeds the guana in size. The head is covered, as in the green lizard, with large scales or plates; the body with small and somewhat square scales, which are so disposed as to mark the sides into numerous tapering annuli or

striae, passing from the back perpendicularly downwards, and from the sides perpendicularly upwards, the narrow end of each row alternating with the broader end of the opposite one: and in the younger animals a kind of plaited appearance, or continued lateral wrinkle appears to pass along each side of the animal; the tail, which is very long, is surrounded by extremely numerous rings of small square scales, and tapers to a slender point. The colour in the larger animals is highly beautiful, consisting of an elegant, and in general somewhat minute variegation of brown, or blackish and purple spots, on a pale bluish-white, and in some parts yellowish ground. The whole form of the animal is rather thick or plump, in comparison with many other lizards: the tongue is broad, flat, long, forked at the tip, and curiously serrated on each side; the head shaped like that of the *Arneivo*, to which this species is nearly allied. It is a native of South America.

The *Green lizard* is a native of both Europe and India. This species is also extremely nimble; it basks on the sides of dry banks, or under old trees in the hot weather, but, on being observed, immediately retreats to its hole. The food of this, as well as all other British lizards, is insects; and they themselves are devoured by birds of prey. They are all perfectly harmless, yet their form strikes almost every beholder with disgust, and has occasioned great obscurity in their history. Mr. Pennant mentions a lizard killed in Worcestershire, in the year 1714, which was two feet six inches long, and four inches in girth; the fore-legs were placed eight inches from the head, the hind-legs five inches behind those; the legs were two inches long; and the feet divided into four toes, each furnished with a sharp claw. Another of the same kind was afterwards killed in that county; but whether these large lizards were natives of other countries, and imported into England, or whether they were of British growth, is uncertain, though the former is more probable, as in this country they scarcely ever exceed six inches. This species has a pretty long verticulated tail, with sharp scales, and a scaly collar.

The green lizard of Carolina is denominated from its colour. It is very slender; the tail nearly double the length of the body; and the whole length above five inches. It inhabits Carolina, where it is domestic, familiar, and harmless. It sports on the tables and windows, and amuses with its agility in catching flies. Cold affects its colours: in that uncertain climate, when there is a quick transition in the same day from hot to cold, it changes instantly from the most brilliant green to a dull brown. They are a prey to cats and ravenous birds. They appear chiefly in summer: and at the approach of cold weather they retire to their winter recesses, and lie torpid in the holes and crevices of hollow trees. It frequently happens, that a few warm sunshiny days so invigorate them, that they will come out of their holes and appear abroad; when on a sudden the weather changes to cold, they become so feeble as to be unable to return to their retreats, and consequently expire.

The *Nimble lizard*, an elegant little creature, known in almost every part of the temperate regions of Europe, seems to be the most gentle and inoffensive, and at the same time, the most useful of all the lizard tribe. It is fond of basking in the sun; but, unable to bear excessive heat, in the hottest weather it seeks for shelter. In spring, during fine weather, it may sometimes be seen luxuriously extended on a sloping green bank, or on a wall exposed to the sun. In these situations it enjoys the full effects of the reviving warmth, expressing its delight by gently agitating its slender tail; and its lively and brilliant eyes are animated with pleasure.—Should any of the minute animals, on which it feeds, appear, it springs

upon them with the quickness of thought; and if any danger occurs, the creature itself seeks a more secure retreat with equal rapidity. On the least noise it turns suddenly round, drops down, and seems, for a moment, perfectly stupified by its fall; or else it suddenly shoots away among the bushes or thick grass. Its wonderful rapidity of motion is chiefly to be observed in warm countries, for in the temperate

regions its evolutions are much more languid. This gentle and peaceful animal excites no sensations of terror; and, when taken into the hand, makes not the smallest attempt either to bite or offend. In some countries, children use it as a play-thing; and, in consequence of its natural gentleness of disposition, it becomes in a great measure tame and familiar.

BOOK III.

OF SERPENTS, ETC.

CHAP. I.

OF SERPENTS IN GENERAL.

We now come to a tribe, that not only their deformity, their venom, their ready malignity, but also our prejudices, and our very religion, have taught us to detest. The serpent has, from the beginning, been the enemy of man; and it has hitherto continued to terrify and annoy him, notwithstanding all the arts that have been practised to destroy it. Formidable in itself, it deters the invader from the pursuit; and, from its figure, capable of finding shelter in a little space, it is not easily discovered by those who would venture to try the encounter. Thus possessed at once of potent arms and inaccessible or secure retreats, it baffles all the arts of man, though never so earnestly bent upon its destruction.

For this reason, there is scarce a country in the world that does not still give birth to this poisonous brood, that seem formed to quell human pride, and repress the boasts of security. Mankind have driven the lion, the tiger, and the wolf, from their vicinity; but the snake and the viper still defy their power, and frequently punish their insolence.

Their numbers, however, are thinned by human assiduity; and it is possible some of the kinds are wholly destroyed. In none of the countries of Europe are they sufficiently numerous to be truly terrible; the philosopher can meditate in the fields without danger; and the lover seek the grove without fearing any wounds but those of metaphor. The various malignity that has been ascribed to European serpents of old is now utterly unknown; there are not above three or four kinds that are dangerous, and their poison operates in all in the same manner. A burning pain in the part, easily removable by timely applications, is the worst effect that we experience from the bite of the most venomous serpents of Europe. The drowsy death, the starting of the

blood from every pore, the insatiable and burning thirst, the melting down the solid mass of the whole form into one heap of putrefaction, these are horrors with which we are entirely unacquainted.

But though we have thus reduced these dangers, having been incapable of wholly removing them, in other parts of the world they still rage with all their ancient malignity. Nature seems to have placed them as sentinels, to deter mankind from spreading too widely, and from seeking new abodes, till they have thoroughly cultivated those at home. In the warm countries that lie within the tropics, as well as in the cold regions of the north, where the inhabitants are few, the serpents propagate in equal proportion. But of all countries, those regions have them in the greatest abundance where the fields are unpeopled and fertile, and where the climate supplies warmth and humidity. All along the swampy banks of the river Niger, or Oroonoko, where the sun is hot, the forests thick, and the men but few, the serpents cling among the branches of the trees in infinite numbers, and carry on an unceasing war against all other animals in their vicinity. Travellers have assured us, that they have often seen large snakes twining round the trunk of a tall tree, encompassing it like a wreath, and thus rising and descending at pleasure. In these countries, therefore, the serpent is too formidable to become an object of curiosity, for it excites much more violent sensations.

We are not, therefore, to reject, as wholly fabulous, the accounts left us by the ancients of the terrible devastations committed by a single serpent. It is probable, in early times, when the arts were little known, and mankind were but thinly scattered over the earth, that serpents, continuing undisturbed possessors of the forests, grew to an amazing magnitude; and every other tribe of animals fell before them. It then might have happened, that serpents reigned the tyrants of a district for centuries together. To animals

of this kind, grown by time and rapacity to a hundred or a hundred and fifty feet in length, the lion, the tiger, and even the elephant itself, were but feeble opponents. The dreadful monster spread desolation round him; every creature that had life was devoured, or fled to a distance. That horrible *fator*, which even the commonest and the most harmless snakes are still found to diffuse, might, in these larger ones, become too powerful for any living being to withstand; and while they preyed without distinction, they might thus also have poisoned the atmosphere around them. In this manner, having for ages lived in the hidden and unpeopled forest, and finding as their appetites were more powerful, the quantity of their prey decreasing, it is possible they might venture boldly from their retreats, into the more cultivated parts of the country, and carry consternation among mankind, as they had before desolation among the lower ranks of nature. We have many histories of antiquity, presenting us such a picture; and exhibiting a whole nation sinking under the ravages of a single serpent. At that time, man had not learned the art of uniting the efforts of many to effect one great purpose. Opposing multitudes only added new victims to the general calamity, and increased mutual embarrassment and terror. The animal was, therefore, to be singly opposed by him who had the greatest strength, the best armour, and the most undaunted courage. In such an encounter hundreds must have fallen; till one, more lucky than the rest, by a fortunate blow, or by taking the monster in its torpid interval, and surcharged with spoil, might kill, and thus rid his country of the destroyer. Such was the original occupation of heroes: and those who first obtained that name, from their destroying the ravagers of the earth, gained it much more deservedly than their successors, who acquired their reputation only for their skill in destroying each other. But as we descend into more enlightened antiquity, we find these animals less formidable, as being attacked in a more successful manner. We are told, that while Regulus led his army along the banks of the river Bagrada, in Africa, an enormous serpent disputed his passage over. We are assured by Pliny, who says, that he himself saw the skin, that it was a hundred and twenty feet long, and that it had destroyed many of the army. At last, however, the battering engines were brought out against it; and these assailing it at a distance, it was soon destroyed. Its spoils were carried to Rome, and the general was decreed an ovation for his success. There are, perhaps, few facts better ascertained in history than this: an ovation was a remarkable honour; and was given only for some signal exploit that did not deserve a triumph: no historian would offer to invent that part of the story at least, without being subject to the most shameful detection. The skin was kept for several years after in the capitol; and Pliny says,

he saw it there: now, though Pliny was a credulous writer, he was by no means a *false* one; and whatever he says he has seen, we may very safely rely on. At present, indeed, such ravages from serpents are scarcely seen in any part of the world; not but that in Africa and America some of them are powerful enough to brave the assaults of men to this day.

But, happily for us, we are placed at such a distance as to take a view of this tribe without fearing for our safety; we can survey their impotent malignity with the same delight with which the poet describes the terrors of a dead monster.

Nequeant expleri corda tuendo
Terribiles oculos villosaque setis pectora.

To us their slender form, their undulating motion, their vivid colouring, their horrid stench, their forked tongue, and their envenomed fangs, are totally harmless; and in this country their uses even serve to counterbalance the mischief they sometimes occasion.

If we take a survey of serpents in general, they have marks by which they are distinguished from all the rest of animated nature. They have the length and the suppleness of the eel, but want fins to swim with: they have the scaly covering and pointed tail of the lizard, but they want legs to walk with; they have the crawling motion of the worm, but, unlike that animal, they have lungs to breathe with: like all the reptile kind, they are resentful when offended; and nature has supplied them with terrible arms to revenge every injury.

Though they are possessed of very different degrees of malignity, yet they are all formidable to man, and have a strong similitude of form to each other; and it will be proper to mark the general characters before we descend to particulars. With respect to their conformation, all serpents have a very wide mouth, in proportion to the size of the head; and, what is very extraordinary, they can gape and swallow the head of another animal which is three times as big as their own. I have seen a toad taken out of the belly of a snake, at lord Spencer's, near London, the body of which was thrice the diameter of the animal that swallowed it. However, it is no way surprising that the skin of the snake should stretch to receive so large a morsel: the wonder seems how the jaws could take it in. To explain this, it must be observed that the jaws of this animal do not open as ours, in the manner of a pair of hinges, where bones are applied to bones, and play upon one another: on the contrary, the serpent's jaws are held together at the roots by a stretching muscular skin; by which means they open as widely as the animal chooses to stretch them, and admit of a prey much thicker than the snake's own body. The throat, like stretching leather, dilates to admit the morsel; the stomach receives it in part; and the rest

remains in the gullet, till putrefaction and the juices of the serpent's body unite to dissolve it.

As to the teeth, I will talk more of them when I come to treat of the viper's poison; it will be sufficient here to observe, that some serpents have fangs, or canine teeth, and others are without them. The teeth in all are crooked and hollow; and, by a peculiar contrivance, are capable of being erected or depressed at pleasure.¹

The eyes of all serpents are small, if compared to the length of the body; and though differently coloured in different kinds, yet the appearance of all is malign and heavy; and, from their known qualities, they strike the imagination with the idea of a creature meditating mischief. In some, the upper eye-lid is wanting, and the serpent winks only with that below; in others, the animal has a nictitating membrane or skin, resembling that which is found in birds, which keeps the eye clean, and preserves the sight. The substance of the eye in all is hard and horny; the crystalline humour occupying a great part of the globe.

The holes for hearing are very visible in all: but there are no conduits for smelling; though it is probable that some of them enjoy that sense in tolerable perfection.

The tongue in all these animals is long and forked. It is composed of two long fleshy substances, which terminate in sharp points, and are very pliable. At the root it is connected very strongly to the neck by two tendons, that give it a variety of play. Some of the viper kind have tongues a fifth part of the length of their bodies; they are continually darting them out, but they are entirely harmless, and only terrify those who are ignorant of the real situation of their poison.

If from the jaws we go on to the gullet, we shall find it very wide for the animal's size, and capable of being distended to a great degree; at the bottom of this lies the stomach, which is not so capacious, and receives only a part of the prey, while the rest continues in the gullet for diges-

tion. When the substance in the stomach is dissolved into chyle, it passes into the intestines, and from thence goes to nourishment, or to be excluded by the vent.

Like most other animals, serpents are furnished with lungs, which, I suppose, are serviceable in breathing, though we cannot perceive the manner in which this operation is performed; for though serpents are often seen, apparently, to draw in their breath, yet we cannot find the smallest signs of their ever respiring it again. Their lungs, however, are long and large, and doubtless are necessary to promote their languid circulation. The heart is formed as in the tortoise, the frog, and the lizard kinds, so as to work without the assistance of the lungs. It is single, the greatest part of the blood flowing from the great vein to the great artery by the shortest course. By this contrivance of nature we easily gather two consequences—that snakes are amphibious, being equally capable of living on land and in the water; and that also they are torpid in winter, like the bat, the lizard, and other animals formed in the same manner.

The vent in these animals serves for the emission of the urine and the fæces, and for the purposes of generation. The instrument of generation in the male is double, being forked like the tongue; the ovaries in the female are double also; and the aperture is very large, in order to receive the double instrument of the male. They copulate in their retreats; and it is said by the ancients, that, in this situation, they appear like one serpent with two heads: but how far this remark is founded in truth, I do not find any of the moderns that can resolve me.

As the body of this animal is long, slender, and capable of bending in every direction, the number of joints in the back-bone are numerous beyond what one would imagine. In the generality of quadrupeds, they amount to not above thirty or forty; in the serpent kind they amount to a hundred and forty-five from the head to the vent, and twenty-five more from that to the tail.² The number of these joints must give the back-bone a surprising degree of pliancy; but this is still increased by the manner in which each of these joints is locked into the other. In man and quadrupeds, the flat surfaces of the bones are laid one against the other, and bound tight by sinews: but in serpents, the bones play one within the other, like ball and socket, so that they have full motion upon each other in every direction.³ Thus, if a man were to form a machine composed of so many joints as are found in the back of a serpent, he would find it no easy matter to give it such strength and pliancy at the same time. The chain of a watch is but a bungling piece of workmanship in comparison.

Though the number of joints in the back-bone is great, yet that of the ribs is still greater; for,

¹ "The fang of the viper is a clear and curious example of mechanical contrivance. It is a perforated tooth, loose at the root; in its quiet state, lying down flat upon the jaw, but furnished with a muscle, which, with a jerk, and by the pluck, as it were, of a string, suddenly erects it. Under the tooth, close to its root, and communicating with the perforation, lies a small bag containing the venom. When the fang is raised, the closing of the jaw presses its root against the bag underneath, and the force of this compression sends out the fluid with a considerable impetus through the tube in the middle of the tooth. What more unequivocal or effectual apparatus could be devised for the double purpose of at once inflicting the wound and injecting the poison? Yet, though lodged in the mouth, it is so constituted, as, in its inoffensive and quiescent state, not to interfere with the animal's ordinary office of receiving its food. It has been observed also, that none of the harmless serpents, the black snake, &c., have these fangs, but teeth of an equal size; not moveable, as this is, but fixed into the jaw."—*Paley*.

² Vide Charat. Anatom.

³ Derham, p. 396.

from the head to the vent there are two ribs to every joint, which makes their number two hundred and ninety in all. These ribs are furnished with muscles, four in number; which being inserted into the head, run along to the end of the tail, and give the animal great strength and agility in all its motions.

The skin also contributes to its motions, being composed of a number of scales, united to each other by a transparent membrane, which grows harder as it grows older, until the animal changes, which is generally done twice a-year. This cover then bursts near the head, and the serpent creeps from it, by an undulatory motion, in a new skin, much more vivid than the former. If the old slough be then viewed, every scale will be distinctly seen, like a piece of net-work, and will be found greatest where the part of the body they covered was largest.

There is much geometrical neatness in the disposal of the serpent's scales for assisting the animal's sinuous motion. As the edges of the foremost scales lie over the ends of their following scales, so those edges, when the scales are erected, which the animal has a power of doing in a small degree, catch in the ground, like the nails in the wheels of a chariot, and so promote and facilitate the animal's progressive motion. The erecting these scales is by means of a multitude of distinct muscles, with which each is supplied, and one end of which is tacked each to the middle of the foregoing.

In some of the serpent kind there is the exactest symmetry in these scales; in others, they are disposed more irregularly. In some, there are larger scales on the belly, and often answering to the number of ribs; in others, however, the animal is without them. Upon this slight difference Linnaeus has founded his distinctions of the various classes of the serpent tribe. Human curiosity, however, and even human interest, seem to plead for a very different method of distribution. It is not the number of scales on a formidable animal's belly, nor their magnitude or variety, that any way excite our concern. The first question that every man will naturally ask, when he hears of a snake, is, whether it be large? the second, whether it be venomous? In other words, the strongest lines in the animal's history are those that first excite our attention; and these it is every historian's business to display.

When we come to compare serpents with each other, the first great distinction appears in their size; no other tribe of animals differing so widely in this particular. What, for instance, can be so remotely separated as the Great Liboya of Surinam, that grows to thirty-six feet long; and the Little Serpent, at the Cape of Good Hope, and the north of the river Senegal, that is not above three inches, and covers whole sandy deserts with its multitudes! This tribe of animals, like that of fishes, seems to have no bounds put

to their growth: their bones are, in a great measure, cartilaginous, and they are, consequently, capable of great extension: the older, therefore, a serpent becomes, the larger it grows; and as they seem to live to a great age, they arrive at an enormous size.

Leguat assures us, that he saw one at Java that was fifty feet long. Carli mentions their growing to above forty feet; and we have now the skin of one in the Museum, that measures thirty-two. Mr. Wentworth, who had large concerns in the Berbices, in America, assures me, that in that country they grow to an enormous length. He one day sent out a soldier, with an Indian, to kill wild fowl for the table; and they accordingly went some miles from the fort; in pursuing their game, the Indian, who generally marched before, beginning to tire, went to rest himself upon the fallen trunk of a tree, as he supposed it to be; but when he was just going to sit down, the enormous monster began to move, and the poor savage perceiving that he had approached a Liboya, the greatest of all the serpent kind, dropped down in an agony. The soldier, who perceived, at some distance, what had happened, levelled at the serpent's head, and, by a lucky aim, shot it dead: however, he continued his fire till he was assured that the animal was killed; and then going up to rescue his companion, who was fallen motionless by its side, he, to his astonishment, found him dead likewise, being killed by the fright. Upon his return to the fort, and telling what had happened, Mr. Wentworth ordered the animal to be brought up, when it was measured, and found to be thirty-six feet long. He had the skin stuffed, and then sent to Europe, as a present to the Prince of Orange, in whose cabinet it is now to be seen at the Hague; but the skin has shrunk, by drying, two or three feet.

In the East Indies they grow also to an enormous size; particularly in the island of Java, where, we are assured, that one of them will destroy and devour a buffalo. In a letter, printed in the German Ephemerides, we have an account of a combat between an enormous serpent and a buffalo, by a person, who assures us that he was himself a spectator. The serpent had, for some time, been waiting near the brink of a pool, in expectation of its prey; when a buffalo was the first that offered. Having darted upon the affrighted animal, it instantly began to wrap it round with its voluminous twistings; and, at every twist, the bones of the buffalo were heard to crack almost as loud as the report of a cannon. It was in vain that the poor animal struggled and bellowed; its enormous enemy entwined it too closely to get free; till at length, all its bones being mashed to pieces, like those of a malfactor on the wheel, and the whole body reduced to one uniform mass, the serpent untwined its folds to swallow its prey at leisure. To prepare for this, and in order to make the body slip down

the throat more glibly, it was seen to lick the whole body over, and thus cover it with its mucus. It then began to swallow it at that end that offered least resistance; while its length of body was dilated to receive its prey, and thus took in at once a morsel that was three times its own thickness. We are assured by travellers, that these animals are often found with the body of a stag in their gullet, while the horns, which they are unable to swallow, keep sticking out at their mouths.

But it is happy for mankind that the rapacity of these frightful creatures is often their punishment; for whenever any of the serpent kind have gorged themselves in this manner, whenever their body is seen particularly distended with food, they then become torpid, and may be approached and destroyed with safety. Patient of hunger to a surprising degree, whenever they seize and swallow their prey, they seem, like surfeited gluttons, unwieldy, stupid, helpless, and sleepy: they, at that time, seek some retreat, where they may lurk several days together, and digest their meal in safety: the smallest effort, at that time, is capable of destroying them; they can scarcely make any resistance; and they are equally unqualified for flight or opposition: that is the happy opportunity of attacking them with success; at that time the naked Indian himself does not fear to assail them. But it is otherwise when this sleepy interval of digestion is over: they then issue, with famished appetites, from their retreats, and with accumulated terrors, while every animal of the forest flies before them.

Carli describes the Long serpent of Congo making its track through the tall grass, like mowers in a summer's day. He could not, without terror, behold whole lines of grass lying levelled under the sweep of its tail. In this manner it moved forward with great rapidity, until it found a proper situation frequented by its prey: there it continued to lurk, in patient expectation, and would have remained for weeks together, had it not been disturbed by the natives.

Other creatures have a choice in their provision; but the serpent indiscriminately preys upon all; the buffalo, the tiger, and the gazelle. One would think that the porcupine's quills might be sufficient to protect it; but whatever has life serves to appease the hunger of these devouring creatures: porcupines, with all their quills, have been found in their stomachs, when killed and opened; nay, they most frequently are seen to devour each other.

A life of savage hostility in the forest offers the imagination one of the most tremendous pictures in nature. In those burning countries, where the sun dries up every brook for hundreds of miles round: when what had the appearance of a great river in the rainy season, becomes in summer one dreary bed of sand—in those countries, I say, a lake that is never dry, or a brook that is perennial, is considered by every

animal as the greatest convenience of nature. As to food, the luxuriant landscape supplies that in sufficient abundance: it is the want of water that all animals endeavour to remove; and inwardly parched by the heat of the climate, traverse whole deserts to find out a spring. When they have discovered this, no dangers can deter them from attempting to slake their thirst. Thus the neighbourhood of a rivulet, in the heart of the tropical continents, is generally the place where all the hostile tribes of nature draw up for the engagement. On the banks of this little envied spot, thousands of animals of various kinds are seen venturing to quench their thirst, or preparing to seize their prey. The elephants are perceived, in a long line, marching from the darker parts of the forest; the buffaloes are there, depending upon numbers for security; the gazelles, relying solely upon their swiftness; the lion and tiger waiting a proper opportunity to seize; but chiefly the larger serpents are upon guard there, and defend the accesses of the lake. Not an hour passes without some dreadful combat; but the serpent, defended by its scales, and naturally capable of sustaining a multitude of wounds, is, of all others, the most formidable. It is the most wakeful also; for the whole tribe sleep with their eyes open, and are consequently for ever upon the watch: so that, till their rapacity is satisfied, few other animals will venture to approach their station.

But though these animals are, of all others, the most voracious, and though the morsel they swallow without chewing is greater than what any other creature, either by land or water, the whale itself not excepted, can devour, yet no animals upon earth bear abstinence so well as they. A single meal, with many of the snake kind, seems to be the adventure of a season; it is an occurrence for which they have been for weeks, nay, sometimes for months, in patient expectation of. When they have seized their prey, their industry, for several weeks, is entirely discontinued; the fortunate capture of an hour often satisfies them for the remaining period of their annual activity. As their blood is colder than that of most other terrestrial animals, and as it circulates but slowly through their bodies, so their powers of digestion are but feeble. Their prey continues for a long time, partly in the stomach, partly in the gullet, and a part is often seen hanging out of the mouth. In this manner, it digests by degrees; and in proportion as the part below is dissolved, the part above is taken in. It is not, therefore, until this tedious operation is entirely performed that the serpent renews its appetite and its activity. But should any accident prevent it from issuing once more from its cell, it still can continue to bear famine for weeks, months, nay, for years together. Vipers are often kept in boxes for six or eight months without any food whatever; and there are little serpents sometimes sent over to Europe from Grand

Cairo, the name of which I have not been able to learn, that live, for several years, in glasses, and never eat at all, nor even stain the glass with their excrements. Thus the serpent tribe unite, in themselves, two very opposite qualities; wonderful abstinence, and yet incredible rapacity.

If, leaving the consideration of their appetites, we come to compare serpents, as to their voices, some are found silent, some have a peculiar cry; but hissing is the sound which they most commonly send forth, either as a call to their kind, or as a threat to their enemies. In the countries where they abound, they are generally silent in the middle of the day, when they are obliged to retire from the heat of the climate; but as the cool of the evening approaches, they are then heard issuing from their cells with continued hissings; and such is the variety of their notes, that some have assured me they very much resemble the music of an English grove. This some will hardly credit—at any rate, such notes, however pleasing, can give but very little delight, when we call to mind the malignity of the minstrel. If considered, indeed, as they answer the animal's own occasions, they will be found well-adapted to its nature, and fully answering the purposes of terrifying such as would venture to offend it.

With respect to motion, some serpents, particularly those of the viper kind, move slowly; while others, such as the Ammodytes, dart with amazing swiftness. The motion in all is similar; but the strength of body in some gives a very different appearance. The viper, that is but a slow feeble-bodied animal, makes way in a heavy undulating manner; advancing its head, then drawing up its tail behind, and bending its body into a bow; then, from the spot where the head and tail were united, advancing the head forward as before.⁴ This, which is the motion of all ser-

pents, is very different from that of the earth-worm, or the naked snail. The serpent, as was said above, has a back-bone with numerous joints, and this bone the animal has the power of bending in every direction, but without being able to shorten or lengthen it at pleasure. The earth-worm, on the other hand, has no back-bone; but its body is composed of rings, which, like a barber's puff, it can lengthen or shorten as

direct displacement of the mass is produced, as it is necessarily urged from behind forward, so that the head is carried more and more in advance, and the tail follows nearly in the same direction. This progression, however, in the greater number of cases, takes effect at the same time on the lateral parts of the body by a series of undulations or sinuosities, which obtain for the serpent points of support on the objects which present some resistance to it on the right or left. It may then be observed to curve its spine regularly according to its length, to produce sinuous and arched lines in it, which are successively effaced, become formed anew, and reproduced as often as the obstacle encountered continues to offer resistance to the pressure. This is the mode of moving we observe in eels, as well as in certain saurians with a very long body and destitute of feet, such as the species of the genus *Anguis*; and it is therefore likewise called, when it takes place among these animals, a serpentine motion. Such is the mechanism of creeping or reptation. When a serpent requires to raise itself, or place a portion of its body in an upright position, if it then meet with a solid object, it applies its trunk to it, elevates and stiffens its body by directing its efforts to the fixed point, and making the series of plates in the anterior part of the belly, and consequently, those succeeding form an arch. When, on the contrary, the ground is level, the same movements are produced on the parts of the trunk which rest on the ground. The whole anterior region of the body there finds a kind of solid fold, which supports it like the base of a pillar raised upon itself. The serpent is then seen to carry its head vertically, somewhat like a swan's neck, in order to turn and move it gently in every direction, as may be witnessed in the *Najas* or hooded snakes, when they assume various singular attitudes, appearing at the same time to follow the measure of music varied by the instruments or songs of the Indian jugglers, who often publicly exhibit these kinds of dances, in which the snakes have been previously exercised by various manœuvres. The active leap is produced, as is known, by the darting of the whole living mass, which all at once completely and voluntarily leaves the surface on which it rested, in order to spring freely over a distance more or less considerable. Although destitute of articulated limbs, serpents still enjoy this power, but by processes as peculiar as can well be conceived. Thus at times the reptile, having its body rolled in a circle on itself, keeps it stretched like an elastic spring, remaining spirally twisted by the contractile force of the muscles of the internal lateral region, concave or concentric to the spine; but all of a sudden it relaxes itself by the instantaneous shortening of the convex or external edge of the circumference, which, becoming suddenly elongated or extended, unfolds with great force and rapidity. Sometimes, in order to effect a more rapid change of place, to recede or advance with more celerity, the serpent executes in this way a series of successive bounds, which are produced in the direction of its length by means of undulations on the sides, from before or from above downwards, and reciprocally, with slight sinuosities which alternately correct each other."—*M. Dumeril.*

⁴ "Creeping is the most general mode of progression among serpents; this act is produced by a series of successive contractions communicated to their long spine by the numerous muscles inserted in the vertebrae and ribs. In order to understand rightly how this act or reptation, takes place, we must suppose that the animal, being stationary, or having made a momentary pause, has halted on a surface more or less resisting, on which it finds a point of support. Most commonly it is the belly or under part of the body which is applied to such support. It first raises the posterior moveable edge of one or more solid bony plates, with which the abdomen and tail are furnished, in such a way as to move forward the plates situated further forward, on which it then seems to glide, then successively on all those which precede; for these plates act by means of the ribs which are inserted into them, so that they move like so many feet, which would nearly correspond to those we observe in the body of *Juli* and other myriapodous insects. These movements taking place at the same time, and in the same manner, follow each other regularly, and are repeated in a beautiful successive order along the whole length of the inferior region of the body. We may thus conceive how the

it finds necessary. The earth-worm, therefore, in order to move forward, lengthens the body; then, by the fore-part clings to the ground, where it has reached, and then contracts and brings up its rear: then, when the body is thus shortened, the fore-part is lengthened again for another progression; and so on. The serpent, instead of shortening the body, bends it into an arch; and this is the principal difference between serpentine and vermicular progression.

I have instanced this motion in the viper, as most easily discerned; but there are many serpents which dart with such amazing swiftness, that they appear rather to leap than crawl. It is most probable, however, that no serpent can dart upon even ground farther than its own length at one effort. Our fears, indeed, may increase the force of their speed, which is sometimes found so fatal. We are told by some, that they will dart to a very great distance; but this my inquiries have never been able to ascertain. The manner of progression in the swiftest serpent we know, which is the jacalus, is by instantly coiling itself upon its tail, and darting from thence to its full extent; then carrying the tail as quick as lightning to the head, coiling and darting again; and by this means proceeding with extreme rapidity, without ever quitting the ground. Indeed, if we consider the length and the weakness of the back-bone in all these animals; if we regard the make of their vertebrae, in which we shall find the junctures all formed to give play, and none to give power; we cannot be of opinion that they have a faculty of springing from the ground, as they entirely want a *fulcrum*, if I may so express it, from whence to take their spring; the whole body being composed of unsupported muscles and joints that are yielding. It must be confessed, that they dart down from trees upon their prey; but their weight alone is sufficient for that purpose without much effort of their own.

Though all serpents are amphibious, some are much fonder of the water than others; and, though destitute of fins or gills, remain at the bottom, or swim along the surface with great ease. From their internal structure, just sketched above, we see how well-adapted they are for either element; and how capable their blood is of circulating at the bottom, as freely as in the frog or the tortoise. They can, however, endure to live in fresh-water only; for salt is an effectual bane to the whole tribe. The greatest serpents are most usually found in fresh-water, either choosing it as their favourite element, or finding their prey in such places in the greatest abundance. But that all will live and swim in liquids appears from the experiment of Rhedi; who put a serpent into a large glass vessel of wine, where it lived swimming about six hours; though, when it was by force immersed, and kept under that liquid, it lived only one hour and a half. He put another in common water,

where it lived three days; but when it was kept under water, it lived only about twelve hours.⁵ Their motion there, however, is perfectly the reverse of what it is upon land; for, in order to support themselves on an element lighter than their bodies, they are obliged to increase their surface in a very artificial manner. On earth their windings are perpendicular to the surface; in water they are parallel to it; in other words, if I should wave my hand up and down, it will give an idea of the animal's progress on land; if I should wave it to the right and left, it will give some idea of its progress on the water.

Some serpents have a most horrible factor attending them, which is alone capable of intimidating the brave. This proceeds from two glands near the vent, like those in the weasel or polecat; and, like those animals, in proportion as they are excited by rage, or by fear, the scent grows stronger. It would seem, however, that such serpents as are most venomous, are least offensive in this particular; since the rattlesnake and the viper have no smell whatever: nay, we are told that at Calicut and Cranganon, in the East Indies, there are some very noxious serpents who are so far from being disagreeable, that their excrements are sought after, and kept as the most pleasing perfume. The Esculapian serpent is also of this number.

Some serpents bring forth their young alive, as the viper; some bring forth eggs, which are hatched by the heat of their situation, as the common black snake, and the majority of the serpent tribe. When a reader, ignorant of anatomy, is told, that some of those animals produce their young alive, and that some produce eggs only, he is apt to suppose a very great difference in the internal conformation, which makes such a variety in the manner of bringing forth. But this is not the case: these animals are internally alike, in whatever manner they produce their young; and the variety in their bringing forth is rather a slight than a real discrimination. The only difference is, that the viper hatches her eggs, and brings them to maturity in her body; the snake is more premature in her productions, and sends her eggs into the light some time before the young ones are capable of leaving the shell. Thus, if either are opened, the eggs will be found in the womb, covered with their membranous shell, and adhering to each other like large beads on a string. In the eggs of both, young ones will be found, though at different stages of maturity: those of the viper will crawl and bite the moment the shell that encloses them is broke open; those of the snake are not yet arrived at their perfect form.

Father Labat took a serpent of the viper kind, that was nine feet long, and ordered it to be opened in his presence. He then saw the manner in which the eggs of these animals lie in the

⁵ Rhedi, Exper. p. 170.

womb. In this creature there were six eggs, each of the size of a goose egg, but longer, more pointed, and covered with a membranous skin, by which also they were united to each other. Each of these eggs contained from thirteen to fifteen young ones, about six inches long, and as thick as a goose-quill. Though the female from whence they were taken was spotted, the young seemed to have a variety of colours very different from the parent; and this led the traveller to suppose that the colour was no characteristic mark among serpents. These little mischievous animals were no sooner let loose from the shell than they crept about, and put themselves into a threatening posture, coiling themselves up, and biting the stick with which he was destroying them. In this manner he killed seventy-four young ones; those that were contained in one of the eggs escaped at the place where the female was killed by the bursting of the egg, and their getting among the bushes.

The last distinction that I shall mention, but the most material among serpents, is, that some are venomous, and some inoffensive. If we consider the poison of serpents as it relates to man, there is no doubt but that it is a scourge and an affliction. The various calamities that the poison of serpents is capable of producing, are not only inflicted by the animal itself, but by men, more mischievous than even serpents, who prepare their venom to destroy each other. With this the savages poison their arms, and also prepare their revengeful potions. The ancients were known to preserve it for the purposes of suicide; and even among semi-barbarous countries at this day the venom of snakes is used as a philtre.

But, though the poison be justly terrible to us, it has been given to very good purposes for the animal's own proper support and defence. Without this, serpents, of all other animals, would be the most exposed and defenceless: without feet for escaping a pursuit; without teeth capable of inflicting a dangerous wound, or without strength for resistance; incapable, from their size, of finding security in very small retreats, like the earth-worm, and disgusting all from their deformity, nothing was left for them but a speedy extirpation. But furnished as they are with powerful poison, every rank of animals approach them with dread, and never seize them but at an advantage. Nor is this all the advantage they derive from it. The malignity of a few serves for the protection of all. Though not above a tenth of their number are actually venomous, yet the similitude they all bear to each other excites a general terror of the whole tribe; and the uncertainty of their enemies in which the poison chiefly resides, makes even the most harmless formidable.—Thus Providence seems to have acted with double precaution; it has given some of them poison, for the general defence of a tribe naturally feeble; but it has thinned the numbers of those which are venomous, lest they

should become too powerful for the rest of animated nature.

From these noxious qualities in the serpent kind, it is no wonder that not only man, but the beasts and birds, carry on an unceasing war against them. The ichneumon of the Indians, and the peccary of America, destroy them in great numbers. These animals have the art of seizing them near the head; and it is said that they can skin them with great dexterity. The vulture and the eagle also prey upon them in great abundance; and often sousing down from the clouds, drop upon a long serpent, which they snatch up struggling and writhing in the air. Dogs are also bred up to oppose them. Father Feuille tells us, that being in the woods of Martinico, he was attacked by a large serpent, which he could not easily avoid, when his dog immediately came to his relief, and seized the assailant with great courage. The serpent entwined him, and pressed him so violently, that the blood came out of his mouth, and yet the dog never ceased till he had torn it to pieces. The dog was not sensible of his wounds during the fight; but soon after his head swelled prodigiously, and he lay on the ground as dead. But his master having found hard by a banana-tree, he applied its juice, mixed with treacle, to the wounds, which recovered the dog, and quickly healed his sores.

But it is in man that these venomous creatures find the most dangerous enemy. The *Psyli* of old were famous for charming and destroying serpents. Some moderns pretend to the same art. Casaubon says, that he knew a man who could at any time summon a hundred serpents together, and draw them into the fire. Upon a certain occasion, when one of them, bigger than the rest would not be brought in, he only repeated his charm, and it came forward like the rest, to submit to the flames. Philostratus describes particularly how the Indians charm serpents. "They take a scarlet robe, embroidered with golden letters, and spread it before a serpent's hole. The golden letters have a fascinating power; and, by looking steadfastly, the serpent's eyes are overcome and laid asleep." These, and many other feats have been often practised upon these animals by artful men, who had first prepared the serpents for their exercise, and then exhibited them as adventitiously assembled at their call. In India there is nothing so common as dancing serpents, which are carried about in a broad flat vessel, somewhat resembling a sieve. These erect and put themselves in motion at the word of command. When their keeper sings a slow tune, they seem by their heads to keep time; when he sings a quicker measure, they appear to move more brisk and lively.⁶ All animals have

⁶ There is a caste of Hindoos of an itinerant character, who are in the habit of going through the various provinces of Hindostan under the accepted appellation of Snake-catchers. These men are furnished with small baskets, containing various speci-

a certain degree of docility; and we find that serpents themselves can be brought to move and approach at the voice of their master. From this trick, successfully practised before the ignorant,

mens of deadly serpents. These hideous reptiles they handle with impunity. Holding in their left hand a small tabor or pipe, they produce an inharmonious sound, themselves apparently labouring under an extravagant course of excitement. The lids or covers of the baskets are then uplifted, and the serpents abstract themselves from their "latebræ" and circumsolve the charmer. With his right hand he suddenly grasps the nearest snake, with his crest fully expanded, whilst the creature emits a sibillous accent of menace, with an undulation of the neck. The "somp waller," or snake-man, then exposes his naked arm to the surrounding group of serpents, which they seize with an impetuous eagerness, and the blood may be perceived following the infliction of the wounds, and yet these men appear to suffer no inconvenience from these desperate experiments, but profess themselves fated to resist that ultimatum which would prove destructive to the life of an individual of any other caste but their own. Some have imagined that these men have a method of abstracting the poison from the fangs of these deadly reptiles before they exhibit them to the public, and yet instances have occurred where the men bitten have perished under the most violent convulsions within an hour after they had sustained the bite of the animal. But there is a practice pursued by these itinerants which is not generally known, by which they successfully impose upon credulous Europeans. A gentleman, we are told, residing at Entally, near Calcutta, whilst walking one afternoon in his garden, accompanied by a small terrier dog, surprised a large snake encouched in a tuft of grass at the foot of a guava tree. The snake glided away into a godown containing empty bottles and other neutral stores. He perceived that the serpent was of that dangerous class denominated the cobra capello, from the expansion of its hood, and he was not in a small degree alarmed to know that he had so awkward a tenant upon his premises. In the course of a few days afterwards a set of snake-men called at the house, and as these persons profess to charm serpents out of their fastnesses, the gentleman ordered them to repair to the godown into which he saw the cobra capello effect his retreat. They consented to repair thither and produce him, but requested that they might be left to themselves to offer up a prayer to "Sivah," the Goddess of Destruction. This the gentleman did not object to. In less than five minutes the latter was called in to observe the effectual operations of the charmer. The tabor was sounded, the crested head of a huge cobra capello exalted itself from a fissure in the wall, it was instantly grasped at by the charmer, and deposited in his basket. The gentleman felt satisfied that the pest was effectually removed. He was deceived: two days afterwards the snake was observed coiled up in a corner of the godown, and destroyed. The snake-men had introduced one of their own reptiles into the fissure, and had reclaimed it—thus imposing upon credulity.

Professor Luigi Metoxa, of Rome, has published an account of some singular experiments made by him upon snakes. Among others, he endeavoured to ascertain the truth of the assertions of the ancients, respecting the predilection of snakes for music and dancing. In July 1822, about noon, he put into a large box a number of different kinds of snakes, all quite lively, with the exception of some vipers, which were enclosed in a separate box. As soon as they heard the harmonious tones of an organ, all the non-

it is most probable has arisen all the boasted pretensions which some have made to charming of serpents; an art to which the native Americans pretend at this very day. One of Linnæus' pupils, we are told, purchased the secret from an Indian, and then discovered it to his master; but, like all secrets of the kind, it is probable this ended in a few unmeaning words of no efficacy.

Though the generality of mankind regard this formidable race with horror, yet there have been some nations, and there are some at this day, that consider them with veneration and regard. The adoration paid by the ancient Egyptians to a serpent is well known; many of the nations at present along the western coast of Africa retain the same unaccountable veneration. Upon the gold and slave coasts, a stranger, upon entering the cottages of the natives, is often surprised to see the roof swarming with serpents, that cling there without molesting, and unmolested by the natives. But his surprise will increase upon going farther southward to the kingdom of Widah, when he finds that a serpent is the god of the country. This animal, which travellers describe as a huge overgrown creature, has its habitation, its temple, and its priests. These impress the vulgar with an opinion of its virtues; and numbers are daily seen to offer not only their goods, their provisions, and their prayers, at the shrine of their hideous deity, but also their wives and daughters.—These the priests readily accept of, and after some days of penance, return them to their suppliants, much benefited by the serpent's supposed embraces. Such a complicated picture of ignorance and imposture gives no very favourable impressions of our fellow-creatures; but we may say, in defence of human nature, that the most frightful of reptiles is worshipped by the most uncultivated and barbarous of mankind.

From this general picture of the serpent tribe, one great distinction obviously presents itself; namely, into those that are venomous, and those that are wholly destitute of poison. To the first belong the viper, the rattle-snake, the cobra di capello, and all their affinities: to the other, the common black snake, the liboya, the boiguacu, the amphisbæna, and various others, that, though destitute of venom, do not cease to be formidable. I will, therefore, give their history separately, beginning with the venomous class, as they have the strongest claims to our notice and attention.

venomous serpents became agitated in an extraordinary manner; they attached themselves to the sides of the box, and made every effort to escape. The *Elaphis* and the *Coluber Esculapii* turned towards the instrument. The vipers exhibited no symptoms of sensibility. This experiment has been frequently repeated, and with the same results.—Ed.

CHAP. II.

OF VENOMOUS SERPENTS IN GENERAL.

THE poison of serpents has been for ages one of the greatest objects of human consideration. To us, who seldom feel the vengeful wound, it is merely a subject of curiosity; but to those placed in the midst of the serpent tribe, who are every day exposed to some new disaster, it becomes a matter of the most serious importance. To remedy the bite of a serpent is considered, among our physicians, as one of the slightest operations in medicine: but among the physicians of the East, the antidotes for this calamity make up the bulk of their dispensaries. In our colder climates, the venom does not appear with that instantaneous operation which it exhibits in the warmer regions; for either its powers are less exquisite, or our fluids are not carried round in such rapid circulation.

In all countries, however, the poison of the serpent is sufficiently formidable to deserve notice, and to excite our attention to its nature and effects. It will, therefore, in the first place, be proper to describe its seat in the animal, as also the instrument by which the wound is made, and the poison injected. In all this venomous class of reptiles, whether the viper, the rattlesnake, or the cobra di capello, there are two large teeth or fangs that issue from the upper jaw, and that hang out beyond the lower.¹ The rest

¹ Travellers in Brazil, Africa, and India, relate, that many serpents regarded by naturalists as harmless, because they want fangs in front of the palate, are, nevertheless, reputed to be very noxious by the natives. A point so important to science and humanity requires clearing up. For this purpose, M. Duvernoy has made a great number of researches, not only on the serpents in the museum of Strasburg, which he had at his command, but also on those of the Museum of Comparative Anatomy of the Garden of Plants of Paris; and he has presented a memoir on this subject to the Academy of Sciences. From his observations, it appears, that the genera *Dipsas*, *Homalopsis*, or *Cerberus*, ought to be classed among the venomous serpents, as well as several species of *Colubri* hitherto confounded with the harmless *Colubri*, and of which it is necessary to form a new genus. M. Duvernoy has discovered in these serpents, behind the series of maxillary teeth, another larger tooth, separated from the first by a vacant interval, and hollowed by a more or less marked groove along its convexity. But besides this grooved fang, which is always found behind the series of maxillary teeth, the serpents in question have also a venomous gland, occupying the place of the supra-maxillary salivary gland of harmless serpents, or the venomous gland of common venomous serpents.

In these latter, (*Crotali*, *Viperæ*, &c.) the venomous gland consists, according to the researches of M. Duvernoy, of a soft and spongy substance, protected by a more or less thick fibrous envelop, and having a single excretory duct, which opens at the base of the fang. This gland is always connected with the anterior temporal muscle, which is detached in great part from the temples to be fixed to its

of the snake tribe are destitute of these; and it is most probable that wherever these fangs are wanting, the animal is harmless; on the contrary, wherever they are found it is to be avoided as the most pestilent enemy. These are the instruments that seem to place the true distinction between animals of the serpent kind; the wounds which these fangs inflict produce the most dangerous symptoms; the wounds inflicted by the teeth only are attended with nothing more than the ordinary consequences attending the bite of any other animal. Our first great attention, therefore, upon seeing a serpent, should be directed to the teeth. If it has the fang teeth, it is to be placed among the venomous class; if it wants them, it may be set down as inoffensive. I am not ignorant that many serpents are said to be dangerous whose jaws are unfurnished with fangs; but it is most probable that our terrors only have furnished these animals with venom; for, of all the tribe whose teeth are thus formed, not one will be found to have a bag for containing poison, nor a conduit for injecting it into the wound. The Black snake, the Liboya, the Blind worm, and a hundred others that might be mentioned, have their teeth of an equal size, fixed into the jaws, and with no other apparatus for inflicting a dangerous wound than a dog or a

capsule; it has, therefore, the remarkable character of possessing a voluntary muscle for compression. In serpents with posterior fangs, the venomous gland is equally soft, spongy, and not granulated: circumstances which distinguish it from the salivary glands, as has been already observed by Schlegel; but it never has that thick and fibrous envelop which everywhere covers the venomous gland of *Viperæ*, *Crotali*, and other venomous serpents, properly so called. In serpents with posterior fangs, the anterior temporal muscle is scarcely connected with the gland, which it covers a little in some cases, undoubtedly to compress it also, but under which it descends in other cases, as under the supra-maxillary gland in the harmless *Colubri*. In serpents with posterior fangs, as in those with anterior ones, the supra-maxillary gland has been interrupted in its development, and is sometimes found reduced to the most rudimentary state. The lachrymal gland is always, in the harmless *Colubri*, of a size equalling at least the ball of the eye; placed chiefly behind the orbit, it appears to have as important a function in the venomous serpents with posterior fangs, as in harmless serpents; whilst, in the common venomous serpents, it is frequently reduced to its small intra-orbital portion. In this case, the anterior temporal muscle which no longer compresses it, belongs more exclusively to the venomous gland. The venomous apparatus of serpents, with posterior fangs, is, therefore, much less perfect, much less fit for attack, for piercing a wound, and distilling venom into it, than that of serpents with anterior fangs. The venomous gland can scarcely be compressed in some species by the anterior temporal muscle; in other species, it is entirely incapable of this action. Besides these imperfections, the generally smaller size of the posterior fangs will easily show how the latter serpents are much less celebrated than the venomous serpents, properly so called, the more active nature of their venom not compensating for the imperfections of their dental apparatus.—*Bull. des Sci. Nat.* Oct. 1830.

lizard: but it is otherwise with the venomous tribe we are now describing; these are well furnished, not only with an elaboratory where the poison is formed, but a canal by which it is conducted to the jaw, a bag under the tooth for keeping it ready for every occasion, and also an aperture in the tooth itself for injecting it into the wound. To be more particular: the glands that serve to fabricate this venomous fluid are situated on each side of the head behind the eyes, and have their canals leading from thence to the bottom of the fangs in the upper jaw, where they empty into a kind of bladder, from whence the fangs on each side are seen to grow. The venom contained in this bladder is a yellowish thick tasteless liquor, which injected into the blood is death, yet which may be swallowed without any danger.

The fangs that give the wound come next under observation; they are large in proportion to the size of the animal that bears them; crooked, yet sharp enough to inflict a ready wound. They grow one on each side, and sometimes two, from two moveable bones in the upper jaw, which by sliding backward or forward, have a power of erecting or depressing the teeth at pleasure. In these bones are also fixed many teeth, but no way venomous, and only serving to take and hold the animal's prey. Besides this apt disposition of the fangs, they are hollow within, and have an opening towards the point, like the slit of a pen, through which, when the fang is pressed down upon the bladder where it grows, there is seen to issue a part of the venom that lay below. To describe this operation at once: when the serpent is irritated to give a venomous wound, it opens its formidable jaws to the widest extent; the moveable bones of the upper jaw slide forward; the fangs that lay before inclining are thus erected; they are struck with force into the flesh of the obnoxious person; by meeting resistance at the points, they press upon the bladders of venom from whence they grow; the venom issues up through the hollow of the tooth, and is pressed out through its slit into the wound, which by this time the tooth has made in the skin. Thus from a slight puncture, and the infusion of a drop of venom scarcely larger than the head of a pin, the part is quickly inflamed, and, without a proper antidote, the whole frame contaminated.

The appearances which this venom produces are different, according to the serpent that wounds, or the season, or the strength of the animal that strikes the blow. If a viper inflicts the wound, and the remedy be neglected, the symptoms are not without danger. It first causes an acute pain in the place affected, attended with a swelling, first red, and afterwards livid. This by degrees spreads to the neighbouring parts; great faintness, and a quick, though low and interrupted, pulse ensues; to this succeed great sickness at the stomach, bilious and con-

vulsive vomitings, cold sweats, pains about the navel, and death itself. But the violence of these symptoms depends much on the season of the year, the difference of the climate, the size or rage of the animal, and the depth and situation of the wound. These symptoms are much more violent, and succeed each other more rapidly, after the bite of a rattle-snake; but when the person is bit by the cobra di capello, he dies in an hour, his whole frame being dissolved into a putrid mass of corruption.

Nothing surely can more justly excite our wonder, than that so small a quantity of venom should produce such powerful and deadly effects. If the venom itself be examined through a microscope, it will be found to shoot into little crystals, that, to an imagination already impressed with its potency, look like so many darts fit for entering the blood-vessels, and wounding their tender coats. But all these darts are wholly of our own making: the softest, mildest fluid whatever, possessed of any consistency, will form crystals under the eye of the microscope, and put on an appearance exactly like the venom of the viper. In fact, this venom has no acrid taste whatever; and to all experiments that our senses can make upon it, appears a slimy insipid fluid. Charas, who often tasted it, assures us of the fact; and asserts, that it may be taken inwardly without any sensible effects, or any prejudice to the constitution. But the famous experiments that were tried by Rhedi and others, in the presence of the Great Duke of Tuscany and his court, put this beyond any doubt whatsoever. By these it appeared, that the serpent having once bitten, exhausted for that time the greatest part of its poison; and though the wound caused by its biting a second time was attended with some malignant symptoms, yet they were much milder than before. It appeared that the serpent biting upon a sponge, or a piece of soft bread, and then biting a dog immediately after, did not inflict a wound more dangerous than the prick of a needle. It appeared that the venom being collected, and a needle dipped therein, this produced almost as painful effects as the tooth of the animal itself. But what caused the greatest surprise in the court was, the seeming rashness of one Tozzi, a viper-catcher; who, while the philosophers were giving elaborate lectures on the danger of the poison when taken internally, boldly desired a large quantity of it might be put together; and then, with the utmost confidence, drank it off before them all. The court was struck with astonishment, and expected that the man would instantly fall dead; but they soon perceived their mistake, and found that taken in this manner, the poison was as harmless as water; so true is that famous passage of Lucan,

Noxia serpentum est admixto sanguine pestis:
Morsu virus habent, et fatum in dento minantur:
Pocula morte carent.

What then shall we say to the speedy effect of so seemingly harmless a liquid taken into the circulation? Let us first observe, that milk is one of the most mild and nourishing of all fluids, and seemingly the most friendly to the human constitution; yet if milk be injected into a vein it will quickly become fatal, and kill with more certain destruction than even the venom of the viper. From hence then we may infer, that the introducing not only of the serpentine venom, but also a quantity of any other mixture, into the circulation will be fatal; and that, consequently serpents kill as well by their power of injecting the wound as by the potency of their poison. Some indeed may inject a more acrimonious mixture, and this may produce more speedy effects; but any mixture thus injected would be dangerous, and many would be fatal.

Ray gives us an instance of the potency of the serpent-poison: which, though it has all the air of a fable, I cannot help transcribing. "A gentleman who went over to the East Indies, while he was one day sitting among some friends, was accosted by an Indian juggler, who offered to show him some experiments respecting the venom of serpents; an exhibition usual enough in that country. Having first, therefore, produced a large serpent, he assured the company that it was harmless; and to convince them of what he said, he tied up his arm, as is usual with those who are going to be bled, and whipped the serpent till it was provoked to bite him. Having drawn in this manner about half a spoonful of blood from his arm, he put the congealed clot upon his thigh. He then took out a much smaller serpent, which was no other than the cobra di capello; and having tied up its neck, he procured about half a drop of its venom, which he sprinkled on the clot of blood on his thigh, which instantly began to ferment and bubble, and soon changed colour from a red into a yellow."

This he pretended was caused by the extreme malignity of that animal's venom: however, I have no doubt that the whole is either a fable, or a trick of the Indian; who, while he seemed to mix the serpent's venom, actually infused some stronger ingredient, some mineral acid, into the mass of blood, which was capable of working such a change. It cannot be supposed that any animal poison could act so powerfully upon the blood already drawn and coagulated; for a poison that could operate thus instantaneously upon cold blood, could not fail of soon destroying the animal itself.

Be this as it will, the effects of serpent-poison are but too well known, though the manner of operation be not so clear. As none of this malignant tribe grow to a great size, the longest of them not exceeding nine feet, they seldom seek the combat with larger animals, or offend others till they are first offended. Did they exert their malignity in proportion to their power, they

could easily drive the ranks of nature before them; but they seem unconscious of their own superiority, and rather fly than offer to meet the meanest opposer. Their food chiefly consists of small prey, such as birds, moles, toads, and lizards; so that they never attack the more formidable animals, that would seldom die unrevenged. They lurk, therefore, in the clefts of rocks, or among stony places; they twine round the branches of trees, or sun themselves in the long grass at the bottom. There they only seek repose and safety. If some unwary traveller invades their retreats, their first effort is to fly; but when either pursued or accidentally trod upon, they then make a fierce and fatal resistance. For this purpose they raise themselves according to their strength upon their tail, erect the head, seize the limb that presses them, the wound is given, and the head withdrawn in a moment. It is not therefore without reason, that the Asiatics, who live in regions where serpents greatly abound, wear boots and long clothes, which very well protect their lower parts from the accidental resentment of their reptile annoyers.

In the eastern and western Indies, the number of noxious serpents is various; in this country we are acquainted only with one. The viper is the only animal in Great Britain from whose bite we have anything to fear. In the tropical climates, the rattle-snake, the whip-snake, and the cobra di capello, are the most formidable, though by no means the most common. From the general notoriety of these particular serpents, and the universal terror which they occasion, it would seem that few others are possessed of such powerful malignity.

Vipers are found in many parts of this island; but the dry, stony, and particularly the chalky countries, abound with them. This animal seldom grows to greater length than two feet; though sometimes they are found above three. The ground colour of their bodies is a dirty yellow; that of the female is deeper. The back is marked the whole length with a series of rhomboid black spots, touching each other at the points; the sides with triangular ones; the belly entirely black. It is chiefly distinguished from the common black snake by the colour, which in the latter is more beautifully mottled, as well as by the head, which is thicker than the body; but particularly by the tail, which in the viper, though it ends in a point, does not run tapering to so great a length as in the other. When, therefore, other distinctions fail, the difference of the tail can be discerned at a single glance.

The viper differs from most other serpents in being much slower, as also in excluding its young completely formed, and bringing them forth alive. The kindness of Providence seems exerted, not only in diminishing the speed, but also the fertility, of this dangerous creature. They copulate in May, and are supposed to be about three

months before they bring forth, and have seldom above eleven eggs at a time. These are of the size of a blackbird's egg, and chained together in the womb like a string of beads. Each egg contains from one to four young ones: so that the whole of a brood may amount to about twenty or thirty. They continue in the womb till they come to such perfection as to be able to burst from their shell; and they are said by their own efforts to creep from their confinement into the open air, where they continue for several days without taking any food whatsoever. "We have been assured," says Mr. Pennant, "by intelligent people, of the truth of a fact, that the young of the viper, when terrified, will run down the throat of the parent, and seek shelter in its belly, in the same manner as the young of the opossum retire into the ventral pouch of the old one. From this," continues he, "some have imagined, that the viper is so unnatural as to devour its own young; but this deserves no credit, as these animals live upon frogs, toads, lizards, and young birds, which they swallow whole, though the morsel is often three times as thick as their own body."

The viper is capable of supporting very long abstinence, it being known that some have been kept in a box six months without food; yet during the whole time they did not abate of their vivacity. They feed only a small part of the year, but never during their confinement; for if mice, their favourite diet, should at that time be thrown into their box, though they will kill, yet they will never eat them. When at liberty, they remain torpid throughout the winter; yet, when confined, have never been observed to take their annual repose. Their poison, however, decreases in proportion to the length of their confinement; and it is thought that the virtues of the animal's flesh, are, by the same restraints, considerably lessened.

They are usually taken with wooden tongs, by the end of the tail, which may be done without danger; for, while held in that position, they are unable to wind themselves up to hurt their enemy; yet, notwithstanding this precaution, the viper-catchers are frequently bit by them; but, by the application of olive-oil, the bite is effectually cured.

One William Oliver, a viper-catcher at Bath, was the first who discovered this admirable remedy. On the first of June, 1735, in the presence of a great number of persons, he suffered himself to be bit by an old black viper, (brought by one of the company,) upon the wrist and joint of the thumb of the right hand, so that drops of blood came out of the wounds: he immediately felt a violent pain, both at the top of his thumb and up his arm, even before the viper was loosened from his hand; soon after he felt a pain, resembling that of burning, trickle up his arm; in a few minutes his eyes began to look red and fiery, and to water much; in less than an hour he per-

ceived the venom seize his heart, with a pricking pain, which was attended with faintness, shortness of breath, and cold sweats; in a few minutes after this, his belly began to swell, with great gripings, and pains in his back, which were attended with vomitings and purgings: during the violence of these symptoms, his sight was gone for several minutes, but he could hear all the while. He said, that in his former experiments he had never deferred making use of his remedy longer than he perceived the effects of the venom reaching his heart; but this time, being willing to satisfy the company thoroughly, and trusting to the speedy effects of his remedy, which was nothing more than olive-oil, he forbore to apply anything till he found himself exceeding ill and quite giddy. About an hour and a quarter after the first of his being bit, a chafing dish of glowing charcoal was brought in, and his naked arm was held over it, as near as he could bear, while his wife rubbed in the oil with her hand, turning his arm continually round, as if she would have roasted it over the coals: he said the poison soon abated, but the swelling did not diminish much. Most violent purgings and vomitings soon ensued; and his pulse became so low, and so often interrupted, that it was thought proper to order him a repetition of cordial potions: he said he was not sensible of any great relief from these; but that a glass or two of olive-oil drank down, seemed to give him ease. Continuing in this dangerous condition, he was put to bed, where his arm was again bathed over a pan of charcoal, and rubbed with olive-oil, heated in a ladle over the charcoal, by Dr. Mortimer's direction, who was the physician that drew up the account. From this last operation he declared that he found immediate ease, as though by some charm: he soon after fell into a profound sleep, and, after about nine hours' sound rest, awaked about six the next morning, and found himself very well; but in the afternoon, on drinking some rum and strong beer, so as to be almost intoxicated, the swelling returned, with much pain and cold sweats, which abated soon, on bathing the arm as before, and wrapping it up in brown paper soaked in the oil.²

² The viper is pretty generally extended in all the woody, mountainous, and stony districts of temperate and southern Europe. It is common on the borders of dry coppices, on rocks and sands exposed to the sun, and is found throughout the whole of France, the British islands, Germany, Sweden, Poland, Russia, Italy, and even as far as Siberia and Norway. But very recently it multiplied to an alarming extent in the forest of Fontainebleau, where it was known under the name of *aspic*. It lives on small quadrupeds, mice, field-mice, lizards, frogs, toads, salamanders, young birds, and insects, such as flies, ants, cantharides, and even scorpions, according to Aristotle. It also feeds on mollusca, and worms, and, like all the Ophidians, can support without any material suffering a fast of many months. In many shops of pharmacoplists it is said that vipers have been kept in casks for years without giving them any thing to

Such are the effects of the viper's bite; yet its flesh has long been celebrated as a noble medicine. A broth, made by boiling one viper in a quart of water till it comes to a pint, is the usual method in which it is given at present; and it is said to be a very powerful restorative in battered constitutions: the salt of vipers is also thought to exceed any other animal salt whatever, in giving vigour to the languid circulation, and prompting to venery.

The Rattle-snake is bred in America, and in no part of the old world. Some are as thick as a man's leg, and six feet in length; but the most usual size is from four to five feet long. In most particulars it resembles the viper: like that animal having a large head and a small neck, being of a dusky colour, and furnished with fangs that inflict the most terrible wounds. It differs, how-

ever, in having a large scale, which hangs like a penthouse over each eye. The eye also is furnished with a nictitating membrane, that preserves it from dust; and its scales are of a considerable degree of hardness. They are of an orange, tawny, and blackish colour on the back; and of an ash-colour on the belly, inclining to lead. The male may be readily distinguished from the female, by a black velvet spot on the head, and by the head being smaller and longer. But that which, besides their superior malignity, distinguishes them from all other animals, is their rattle, an instrument lodged in their tail, by which they make such a loud rattling noise, when they move, that their approach may readily be perceived, and the danger avoided. This rattle, which is placed in the tail, somewhat resembles, when taken out of the body, the curb-chain of a bridle: it is composed of several thin, hard, hollow bones, linked to each other, and rattling upon the slightest motion. It is supposed by some that the snake acquires an additional bone every year; and that, from hence, its age may be precisely known: however this may be, certain it is, that the young snakes, of a year or two old, have no rattles at all; while many old ones have been killed, that had from eleven to thirteen joints each. They shake and make a noise with the rattles with prodigious quickness, when they are disturbed; however, the peccary and the vulture are no way terrified at the sound, but hasten, at the signal, to seize the snake, as their most favourite prey.

It is very different with almost every other animal. The certain death which ensues from this terrible creature's bite, makes a solitude wherever it is heard. It moves along with the most majestic rapidity; neither seeking to offend the larger animals, nor fearing their insults. If unprovoked, it never meddles with anything but its natural prey; but when accidentally trod upon, or pursued to be destroyed, it then makes a dreadful and desperate defence. It erects itself upon its tail, throws back the head, and inflicts its wound in a moment; then parts and inflicts a second wound: after which, we are told by some, that it remains torpid and inactive, without even attempting to escape.

The very instant the wound is inflicted, though small in itself, it appears more painful than the sting of a bee. This pain, which is so suddenly felt, far from abating, grows every moment more excruciating and dangerous; the limb swells; the venom reaches the head, which is soon of a monstrous size; the eyes are red and fiery; the heart beats quick, with frequent interruptions; the pain becomes insupportable, and some expire under it in five or six hours; but others, who are of stronger constitutions, survive the agony for a few hours longer, only to sink under a general mortification, which ensues, and corrupts the whole body.

As a gentleman in Virginia was walking in the

eat. It is with considerable difficulty that vipers are destroyed; they will resist very severe wounds, and are not even easily to be strangled. They can remain many hours in the water without perishing, and for some minutes even in brandy. It may also be observed that the number of their enemies is but small. Except man, who wages continual war against them, the wild boar, whose lard secures them from their bite, and the falcons and herons which feed upon them, all other animals, wild and domestic, fear and fly them. The viper is an object of terror to other animals, and the danger which accompanies its bite may sufficiently explain the kind of proscription to which it is generally devoted. It is, without contradiction, the most to be dreaded of all the venomous reptiles of Europe, and the one whose bite is followed by the most grievous, and sometimes fatal consequences. These effects, however, are totally prevented by our mountebanks, by stopping the hole in each of the venomous fangs with some soft wax, without pulling them out, after the fashion of the Egyptian jugglers and the *Psylli* of India. The treatment for the bite of the viper, has been very well indicated by Celsus in his treatise of medicine, and it merits some attention, especially as naturalists are frequently exposed to accidents from this reptile. The first precaution to be observed in a case of this kind, is, when the disposition of the parts will permit, to fix a ligature above the wounded place, and not to tighten it too much, for fear of giving rise to mortification. Immediately after, a cupping-glass is applied on the wound, the parts adjacent being first scarified, and this mode, highly praised by Celsus, has very recently been attended with happy results in the hands of Messrs. Mangili, Barry, and Bouillaud. This method from analogy, affords an additional recommendation to employ the plan of suction, which has received the further confirmation of professional experiments tried by a number of physiologists and physicians. When the cupping-glass has performed its office, the lips of the wound, already scarified, should be cauterized deeply and extensively. This should be done with a red-hot iron, chlorine of antimony, or concreted potassium. A variety of different substances, taken internally, have been lauded from time to time as efficacious against the bite of the viper. Sudorifics have been especially recommended, and among them the flesh of the lizard, of the coluber, and the viper itself, have been preferred, in consequence of the great quantity of ammonia it has been ascertained to contain. An alexipharmic virtue of the same kind has been also attributed to theriaca and other analogous electuaries.

--Ed.

fields for his amusement, he accidentally trode upon a rattle-snake, that had been lurking in a stony place; which, enraged by the pressure, reared up, bit his hand, and shook its rattles. The gentleman readily perceived that he was in the most dreadful danger; but, unwilling to die unrevenged, he killed the snake, and carrying it home in his hand, threw it on the ground before his family, crying out, "I am killed, and there is my murderer." In such an extremity, the speediest remedies were the best. His arm, which was beginning to swell, was tied up near the shoulder, the wound was anointed with oil, and every precaution taken to stop the infection. By the help of a very strong constitution he recovered; but not without feeling the most various and dreadful symptoms for several weeks together. His arm, below the ligature, appeared of several colours, with a writhing among the muscles, that to his terrified imagination appeared like the motions of the animal that wounded him. A fever ensued; the loss of his hair, giddiness, drought, weakness, and nervous faintings; till, by slow degrees, a very strong habit overpowered the latent malignity of the poison.

Several remedies have been tried to alleviate this calamity. A decoction of the Virginian snake-root is considered as the most effectual; and at the same time the head of the animal, bruised and laid upon the part affected, is thought to assist the cure. In general, however, it is found to be fatal; and the Indians, sensible of this, take care to dip their arrows in the poison under the rattle-snake's fangs, when they desire to take signal revenge of their enemies.³

³ The rattle-snakes are, in summer, generally found in pairs: in winter they collect in multitudes, and retire into the ground, beyond the reach of the frost. Tempted by the warmth of a spring day, they are often observed to creep out in a weak and languid state. Mr. Pennant mentions that a person has seen a piece of ground covered with them, and that he killed with a rod between sixty and seventy, till, overpowered with the stench, he was obliged to retire. The poison of the rattle-snake when irritated, or when the weather is exceedingly hot, often proves fatal in a very short time. When angry, this creature's rattle is said to be loud and distinct; but when pleased, to sound like a distinct trepidation, in which nothing can be heard.

Negroes, and others who have been bitten with them, have frequently recovered without any assistance, yet the fatality of its poison has been proved by many experiments. We read in the Philosophical Transactions, that a snake was tied down to a grass plot, and made to bite a healthy cur dog; immediately afterward the poor animal's eyes were fixed, his teeth closed upon his tongue, which was hanging out, his lips were drawn up, so as to leave his teeth and gums bare, and in a quarter of a minute he died. The hair was then taken off by means of hot water, and only one small puncture appeared between his fore-legs, with a bluish-green colour round it. A second dog was brought about half-an-hour afterwards, and the snake bit his ear: he exhibited signs of violent sickness, staggered about for some time, then fell down convulsed, and two or three times got up again: he lived near two hours.

Thus much concerning this animal is agreed upon by every naturalist: there are other circumstances in its history, which are not so well ascertained. And first, its motion, which some

Four days after this, two dogs, as large as common bull-dogs, were bitten by him; the one in the inside of his left thigh, which died exactly in half-a-minute; and the other on the outside of the thigh, which died in four minutes. Captain Hall, in South Carolina, who made these experiments, wished at last to try whether its poison would prove mortal to itself. He therefore hung it up in such a manner that it had about half its length on the ground, and irritated it by two needles fastened to the end of a stick. The creature made several attempts to seize the stick, and then bit itself: it was let down, and in eight or ten minutes was found to be lifeless. The snake was afterwards cut into five pieces, which were successively devoured by a hog, but without receiving any injury in consequence.

Dr. Brickell says he was a witness to an encounter between a dog and a rattle-snake, which was fastened to the ground by a tolerably long string. The snake coiled up, and rattled its tail; and the dog being let loose, seized and attempted to shake it out at full length, but from the weight was preserved from doing it, and in consequence bit him in the ear. He seemed somewhat stunned, and left the place, but returned on being encouraged by the company. In the second encounter he received a bite in his lip, after which the snake bit himself. The dog from that moment appeared senseless of everything around him; even the caresses of his brutal master had no effect; and in less than half-an-hour both the animals were found dead.

An American writer of respectability, asserts that a farmer was one day mowing with his negroes, when he by chance trod on a rattle-snake, that immediately turned upon him and bit his toe. At night, when he went to bed, he was attacked with a sickness; he swelled, and before a physician could be called in he died. All his neighbours were surprised at his sudden death, but the corpse was interred without examination. A few days after one of the sons put on his father's boots: and at night, when he pulled them off, he was seized with the same symptoms, and died on the following morning. The doctor arrived, but unable to define the cause of so singular a disorder, seriously pronounced both the father and the son to have been bewitched. At the sale of effects, a neighbour purchased the boots, and on putting them on experienced the like dreadful symptoms with the father and the son. A skilful physician, however, being sent for, who had heard of the preceding affair, suspected the cause, and by applying proper remedies, recovered his patient. The fatal boots were now carefully examined, and the two fangs of the snake were discovered to have been left in the leather with the poison-bladders adhering to them. They had penetrated entirely through, and both the father and the son had imperceptibly scratched themselves with their points in pulling off the boots.

In the neighbourhood of Rio Janeiro, is an hospital devoted to persons affected with elephantiasis and other disorders of the leprous kind. It is occupied by about eighty patients. A curious anecdote is related of this institution. Some time since an ingenious antiquary announced that the elephantiasis of Brazil was the identical diseases that used to be cured among the ancient Greeks by the bite of a rattle-snake. The assertion made some noise, and one of the patients resolved to try the experiment. The physicians and his friends assembled on the appointed day, and this was the result:—"The serpent was

describe as the swiftest imaginable; asserting, that its Indian name of *Ecacoalt*, which signifies the wind-serpent, implies its agility: others, on the contrary, assert that it is the slowest and the most sluggish of all serpents; and that it seldom moves from one place. In this opposition of opinions, there are others, who assert, that on even ground it moves but slowly; but then, among rocks, that it goes at a great rate. If we may argue from analogy, the opinion of those who contend for its slow motion, seems the most probable; as the viper, which it so very much resembles, is remarkable among serpents for its inactivity.⁴

It is said also by some, that the rattle-snake has a power of charming its prey into its mouth; and this is as strongly contradicted by others. The inhabitants of Pennsylvania are said to have opportunities of observing this strange fascination every day. The snake is often seen basking at the foot of a tree, where birds and squirrels make their residence. There, coiled upon its tail, its jaws extended, and its eyes shining like fire, the rattle-snake levels its dreadful glare upon one of the little animals above. The bird, or the squirrel, whichever it may be, too plainly perceives the mischief meditating against it; and hops from branch to branch, with a timorous plaintive sound, wishing to avoid, yet incapable of breaking through the fascination: thus it continues for some time its feeble efforts and complaints, but is still seen approaching lower and

lower towards the bottom branches of the tree, until, at last, as if overcome by the potency of its fears, it jumps down from the tree directly into the throat of its frightful destroyer.⁵

⁵ M. Le Vaillant says that he saw, on the branch of a tree, a bird trembling as if in convulsions; and at the distance of about four feet, on another branch, a large species of snake that was lying with outstretched neck, and fiery eyes, gazing steadily at the poor animal. The agony of the bird was so great, that it was deprived of the power of moving away; and when one of the party killed the snake, it was found dead upon the spot, and that entirely from fear; for, upon examination, it appeared not to have received the least wound. He adds, that a short time afterwards he observed a small mouse, in similar agonizing convulsions, about two yards distant from a snake, whose eyes were intently fixed upon it; and on frightening away the reptile, and taking up the mouse, it expired in his hand. This gentleman was assured by all the Hottentots who were with him, that this was very common; and the fact was also confirmed by the assertions of all to whom he mentioned these instances.

Mr. Howison, in his 'Sketches of Upper Canada,' gives some curious particulars of the perfume and fascination of these reptiles. He says, "In Upper Canada, it is almost universally believed that snakes possess the power of fascination, which has so often been denied them by naturalists. Many people have had the fact demonstrated to them by being witnesses of it, and this was the case with me. One summer day, when strolling through the woods, I came to the edge of a small pond of water, on the surface of which floated a frog in a state of motionless repose, as if basking in the sun. I carelessly touched his back with a stick, but contrary to my expectation, he did not move; and on viewing him more closely, I perceived that he gasped in a convulsive manner, and was affected with a tremour in his hind-legs. I soon discovered a black snake coiled up, lying near the edge of the pond, and holding the frog in thralldom by the magic of his eyes. Whenever he moved his head to one side or the other, his destined victim followed it, as if under the influence of magnetic attraction; sometimes, however, recoiling feebly, but soon springing forward again, as if it felt 'a strong desire with loathing mixed!' The snake lay with his mouth half open, and never for a moment allowed his eyes to wander from his prey, otherwise the charm would have been instantaneously dissolved! But I determined to effect this, and threw a large chip of wood. It fell between the two animals—the snake started back, while the frog darted under water, and concealed itself among the mud."

Mr. Howison says: "It is asserted by some, that snakes occasionally exert their power of fascination upon human beings, and I see no reason to doubt the truth of this. An old Dutch woman, who lives at the Twelve Mile Creeks in the Niagara district, sometimes gives a minute account of the manner in which she was charmed by a serpent; and a farmer told me, that a similar circumstance occurred to his daughter. It was on a warm summer-day that she was sent to spread out wet clothes on some shrubbery near the house. Her mother conceived that she remained longer than was necessary, and seeing her standing unoccupied at some distance, she called to her several times, but no answer was returned. On approaching, she found her daughter pale, motionless, and fixed in an erect posture. The perspiration rolled down her brow, and her hands were clenched convulsively. A large rattle-snake lay on a log opposite the girl, waving his head from side to

brought into the room in a gaiola, a species of cage. Into this the individual introduced his hand with the most perfect presence of mind. The reptile seemed to shrink from the contact, as though there were something in the part which neutralized its venom. When touched, the serpent would even lick the hand without biting. It became necessary at length for the patient to grasp and squeeze the reptile tightly, in order to receive a thrust from its fangs. The desired thrust was at length given, near the base of the little finger. So little sensation pervaded the member, that the patient was not aware he was bitten, until informed of it by those who saw the act. A little blood oozed from the wound, and a slight swelling appeared when the hand was drawn from the cage, but no pain was felt. Moments of intense anxiety now followed, while it remained to be seen whether the strange application would issue for the better or for the worse. The effects became gradually manifest, although it was evidently retarded by the disease which had pre-occupied the system. In less than twenty-four hours the Lazarus was a corpse."—Ed.

⁴ Rattle-snakes creep slowly, and do not bite but when provoked, or for the purpose of destroying their prey. A man can easily master them, when he perceives them at a distance and takes proper precautions. They never attack him, and cannot possibly overtake him. It is even well known that they sound their rattles some moments before they take vengeance on their aggressors. M. Bose was so little afraid of them, that he took all those alive he met with, and which were not too bulky to be preserved in spirits of wine. When they are seized by the head, they cannot, like other serpents, raise their tail, and twist themselves round one's arm, nor make use of their strength to disengage themselves.—Ed.

In order to ascertain the truth of this story, a mouse was put into a large iron cage, where a rattle-snake was kept, and the effects carefully observed. The mouse remained motionless at one end of the cage; while the snake, at the

side, and kept his eyes steadily fastened upon her. The mother instantly struck the snake with a stick, and the moment he made off the girl recovered herself and burst into tears, but was for some time so weak and agitated that she could not walk home."

Dr. Barton of Pennsylvania has published a memoir on the fascination of the rattle-snake, in which he explodes the singular power attributed to this reptile. Some have said the idea took its rise among the Indians; though this is doubted, and certainly the opinion is not universal among them. The Southern Indians of America hold this snake in high veneration, and even the Delaware Indians had the same notion. Some say that the appearance of fascination is entirely limited to birds that build low, and that the cries of these little creatures to preserve their young is natural, and not owing to the fascination of the snake. The rattle-snake too is not like the black snake, which climbs the trees. When these species begin to glide up the branches, the parent-bird is actuated by her instinctive attachment to her young, and exposes herself to danger to preserve them, and has been known to compel the serpent to leave the tree. When the nestlings first begin to fly, they are not wholly left without the parent's care. In these first attempts they sometimes fall, and then, if the snake is on the ground, they are seized; in this situation, the old bird will dart upon the serpent. Mr. Rittenhouse made this observation. He saw the Swamp-blackbird perched on the back of a large black snake, and pecking it with his bill, at the very time the serpent was in the act of swallowing a young bird. After the snake was killed, the old bird flew away. He says, the cry and actions of the bird were similar to those which are said to be under the power of fascination. The black snake will attack the nest of a Baltimore bird. These are hanging nests at the extremity of a branch. One of these species of reptiles has been seen to hang above the nest, and by twisting its tail round one part of the tree, to dart its stretched out head into the nest, and so glut its appetite on the young nestlings. When the female bird attacks the snake while it is feeding on the young ones, it is safe, but when it has done, the old one often falls a victim to its fury.

Mr. Thomas Blair says on this subject: "In Canada I heard many wonderful stories of snakes charming their prey, particularly birds; but I confess I am myself somewhat sceptical on this head. The following, which exactly agreed with my own opinion on the subject, was related to me by a very respectable farmer, who had previously been a true believer in their fascinating qualities. He was walking in a field near his house, when he perceived a bird fluttering above the stump of a tree, uttering an uncommon cry, and by degrees getting near to the ground. The farmer's attention being drawn by the uncommon cries and motions of the bird, he walked slowly towards it, but it seemed to take no notice of him, and continued still getting closer to the ground. The farmer at last observed that the bird's attention was directed towards a large snake, resting against a stump nearly erect, with its head close to a small hole. The bird (probably encouraged by the presence of the farmer) struck at the snake with his wings, which caused him immediately to drop. On examination, it was found that the bird's nest was within the tree with five unfledged young ones, which the snake had been exerting his ingenuity to procure a part of for his dinner."—Ed.

other, continued fixed, with its eye glaring full on the little animal, and its jaws opened to their widest extent: the mouse for some time seemed eager to escape; but every effort only served to increase its terrors, and to draw it still nearer the enemy; till, after several ineffectual attempts to break the fascination, it was seen to run into the jaws of the rattle-snake, where it was instantly killed.

To these accounts the incredulous oppose the improbability of the fact: they assert, that such a power ascribed to serpents, is only the remnant of a vulgar error, by which it was supposed that serpents could be charmed, and had also a power of charming. They aver, that animals are so far from running down the throat of a rattle-snake, in captivity, that the snake will eat nothing in that state, but actually dies for want of subsistence.

A serpent, called the Whip-snake, is still more venomous than the former. This animal, which is a native of the East, is about five feet long, yet not much thicker than the thong of a coachman's whip. It is exceedingly venomous; and its bite is said to kill in about six hours. One of the Jesuit missionaries, happening to enter into an Indian pagoda, saw what he took to be a whipcord lying on the floor, and stooped to take it up; but, upon handling it, what was his surprise to find that it was animated, and no other than the whip-snake, of which he had heard such formidable accounts: fortune, however, seemed favourable to him, for he grasped it by the head, so that it had no power to bite him, and only twisted its folds up his arm. In this manner he held it, till it was killed by those who came to his assistance.

To this formidable class might be added the Asp, whose bite however is not attended with those drowsy symptoms which the ancients ascribed to it.⁵ The *Jaculus* of Jamaica also is

⁵ The name of *aspic* has been given amongst all civilized nations to a serpent rendered ever memorable by the death of Cleopatra, whose beauty, glory, honours, and deplorable end, have occupied the historians and poets of all nations. It has been only since the expedition of the French to Egypt that the true species of the aspic has been ascertained. During the period of that expedition, the French philosophers attached to the army observed a species of ephidian, regarded as harmless by Linnæus and most herpetologists, but considered as extremely venomous by the traveller, Forskal. This serpent is called *haje* by the inhabitants, and recent travellers have incontestably proved that it is the true aspic of the ancients, which never inhabited Europe; for the reptile which some years since infested the forest of Fontainebleau, and was called by this name, was nothing but a variety of the common viper, and the *aspic* of the Swedes is quite another species from the one in question. Forskal informs us that when the *haje* is provoked, it swells and extends its neck greatly, and then springs with a single bound upon its enemy. This habit of rearing up when it is approached, caused the ancient inhabitants of the countries watered by the Nile, to believe that this serpent guarded the fields which it inhabited. They

one of the swiftest of the serpent kind. The hæmorrhoids, so called from the hæmorrhages which its bite is said to produce; the Seps, whose wound is very venomous, and causes the part affected to corrupt in a very short time; the Coral serpent, which is red, and whose bite is said to be fatal. But of all others, the Cobra di Capello, or Hooded serpent, inflicts the most deadly and incurable wounds.⁶ Of this formida-

made it in consequence the emblem of the protecting divinity of the world. They sculptured it on the two sides of a globe, on the portico of all their temples. It is often exhibited by the jugglers at Cairo, apparently metamorphosed into a rod or wand, which is done by pressing its nape with the finger, and thus causing a sort of catalepsy. They take care, however, to remove the fangs, which might cause very serious accidents. The poison of the haje is excessively violent, and far more deleterious than that of the European viper, which it resembles in its yellowish tint, and its transparency. Forskal relates, that having taken a very small drop of it, and introduced it into a slight incision made in the thigh of a pigeon, he saw this unfortunate bird perish in a quarter of an hour in convulsions and vomitings. The modes adopted against the bite of the haje are the same, for the most part, as those used in the case of that of the viper, particularly cauterization by fire, alcoholized potassum, &c., and the administration of sudorifics internally.—Ed.

⁶ The *naja* or *cobra di capello* is equally remarkable for the elegance of its form, the strength of its body, and the danger which accompanies its bite. It has received the name of spectacle snake, in consequence of a black mark which more or less exactly represents spectacles on the extensible portion of its neck. When the animal is in a state of repose, the neck has no greater diameter than the head, but under the influence of passion, the skin of this part extends in the form of a coil or hood. This serpent inhabits Coromandel, and is not found in Peru or Mexico, as many modern naturalists have erroneously stated, after Seba. It is very formidable from its envenomed bite, which is as dangerous as that of any other species of reptiles. When surprised by some imprudent traveller, it slowly raises its head, swells its neck, and advances against its aggressor in undulating movements executed solely by the tail. In the sixth volume of the 'Asiatic Researches,' Mr. Boaz, after having examined with care the ancient curative processes for the bite of venomous serpents, recommends in the last place as a specific in the dreadful malady caused by the poison of the cobra di capello, nitrate of silver, which was a remedy long since proposed by Fontana in the case of the viper. In the second volume of the same collection, Mr. J. Williams has inserted a paper on the caustic volatile alkali against the deleterious effects of the bite of different serpents, and particularly that of the cobra di capello. It seems that this medicament should be applied both externally on the wound, and at the same time administered internally. A remedy much boasted of by some of the ancient missionaries, who had travelled in the East Indies, and who pretended to cure the bite of the naja, as well as that of other venomous animals, has been proved useless by the experiments of the learned Redi. This is a calculeous concretion, which according to them is formed near the head, or in the body of the serpent in question, and which is named serpent or cobra-stone. This account of the origin of this pretended stone is assuredly false, and it is nothing but a factitious medicament composed by some charlatan. It appears to be nothing but a blackish or greenish argillaceous

ble creature there are five or six different kinds; but they are all equally dangerous, and their bite followed by speedy and certain death. It is from three to eight feet long, with two large fangs hanging out of the upper jaw. It has a broad neck, and a mark of dark brown on the forehead; which, when viewed frontwise, looks like a pair of spectacles; but behind, like the head of a cat. The eyes are fierce, and full of fire; the head is small, and the nose flat, though covered with very large scales, of a yellowish ash-colour; the skin is white, and the large tumour on the neck is flat, and covered with oblong, smooth scales. The bite of this animal is said to be incurable, the patient dying in about an hour after the wound; the whole frame being dissolved into one putrid mass of corruption.

To remedy the bite of all these animals, perhaps salad-oil would be very efficacious: however, the Indians make use of a composition, which is called in Europe, *Petro de Cobra*, or the *Serpent-stone*; and which, applied to the wound, is said to draw out the venom. The composition of this stone, for it is an artificial substance, is kept a secret; and perhaps its effects in extracting the venom may be imaginary: nevertheless, it is certain that it has a power of sticking to the skin, and sucking a part of the blood from the wound. This it may do somewhat in the same manner as we see a tobacco-pipe stick to the lips of a man who is smoking: yet still we are ignorant of the manner; and the secret might probably be of some use in medicine. It were to be wished, therefore, that those who go to India would examine into this composition, and give us the result of their inquiries; but I fear that it is not to benefit mankind, that our travellers now go to India.

CHAP. III.

OF SERPENTS WITHOUT VENOM.

THE class of serpents without poison may be distinguished from those that are venomous by their wanting the fang-teeth: their heads also are not so thick in proportion to their bodies; and, in general, they taper off to the tail more gradually in a point. But, notwithstanding their being destitute of venom, they do not cease to be formidable: some grow to a size by which they become the most powerful animals of the forest; and even the smallest and most harmless of this slender tribe find protection from the similitude of their form.

earth, which has the property of absorbing with great facility the humours which are formed at the surface of any wound whatever. But in India it is believed to imbibe quickly the poison discharged recently into the body of an animal bitten by the naja.—Ed.

The fangs make the great distinction among serpents; and all this tribe are without them. Their teeth are short, numerous, and, in the smaller kinds, perfectly inoffensive: they lie in either jaw, as in frogs and fishes, their points bending backwards, the better to secure their prey. They want that artificial mechanism by which the poisonous tribe inflict such deadly wounds: they have no gland in the head for preparing venom: no conduits for conveying it to the teeth; no receptacles there: no hollow in the instrument that inflicts the wound. Their bite, when the teeth happen to be large enough to penetrate the skin (for, in general, they are too small for this purpose), is attended with no other symptoms than those of an ordinary puncture; and many of this tribe, as if sensible of their own impotence, cannot be provoked to bite, though never so rudely assaulted. They hiss, dart out their forked tongues, erect themselves on the tail, and call up all their terrors to intimidate their aggressors; but seem to consider their teeth as unnecessary instruments of defence, and never attempt to use them. Even among the largest of this kind the teeth are never employed, in the most desperate engagements. When a hare or a bird is caught, the teeth may serve to prevent such small game from escaping; but when a buffalo or a tiger is to be encountered, it is by the strong folds of the body, by the fierce verberations of the tail, that the enemy is destroyed: by thus twining round, and drawing the knot with convulsive energy, this enormous reptile breaks every bone in the animal's body, and then, at one morsel, devours its prey.

From hence we may distinguish the unvenomous tribe into two kinds: first, into those that are seldom found of any considerable magnitude, and that never offend animals larger or more powerful than themselves, but which find their chief protection in flight, or in the doubtfulness of their form; secondly, into such as grow to an enormous size, fear no enemy, but indiscriminately attack all other animals and devour them. Of the first kind is the Common Black snake, the Blind worm, the Esculapian serpent, the Amphisbæna, and several others. Of the second, the Liboia, the Boiguacu, the Depona, and the Boiquatrara.

The Black snake is the largest of English serpents, sometimes exceeding four feet in length. The neck is slender; the middle of the body thick; the back and sides covered with small scales; the belly with oblong, narrow, transverse plaits; the colour of the back and sides is of a dusky brown; the middle of the back marked with two rows of small black spots, running from the head to the tail; the plaits on the belly are dusky; the scales on the sides are of a bluish white; the teeth are small and serrated, lying on each side of the jaws in two rows. The whole species is perfectly inoffensive; taking shelter in dunghills, and among bushes in moist places;

from whence they seldom remove, unless in the midst of the day in summer; when they are called out by the heat to bask themselves in the sun. If disturbed or attacked, they move away among the brambles with great swiftness; but if too closely pursued, they hiss and threaten, and thus render themselves formidable, though incapable of offending.¹

The black snake preys upon frogs, insects, worms, mice, and young birds: and, considering the smallness of the neck, it is amazing how large an animal it will swallow. The black snake of Virginia, which is larger than ours, and generally grows to six feet long, takes a prey proportionable to its size; partridges, chickens, and young ducks. It is generally found in the neighbourhood of the hen-roost, and will devour the eggs even while the hen is sitting upon them: these it swallows whole; and often, after it has done the mischief, will coil itself round in the nest.

The whole of this tribe are oviparous, excluding eighty or a hundred eggs at a time, which are laid in dunghills or hot-beds; the heat of which, aided by that of the sun, brings them to maturity. During winter they lie torpid, in banks or hedges, and under old trees.

The Blind worm is another harmless reptile, with a formidable appearance. The usual length

¹ This snake, though not poisonous, is sometimes bold enough to attack a man, but may be driven off by a smart stroke from a stick, or whatever weapon he may chance to have in his hand. When it overtakes a person who has endeavoured to escape, (not having had courage to oppose it,) it is said to wind itself round his legs in such a manner as to throw him down, and then to bite him several times in the leg, or whatever it can lay hold of, and run off again. In the spring of 1748, Dr. Colden had several workmen at his country seat, and among them one just arrived from Europe, who, of course knew but little the qualities of the black snake. The other workmen, who observed a male and female lying together, out of sport engaged their new companion to kill one of them. He accordingly approached them with a stick in his hand: this the male observed, and made towards him. The man little expected to find such courage in the reptile, and flinging away his stick, ran off as fast as he was able. The snake pursued, overtook him, and twisting several times round his legs, threw him down, and almost frightened the poor fellow out of his senses. He could not rid himself of the animal without cutting it through in two or three places with a knife. The black snake, (which is altogether harmless, except in the spring,) is very greedy of milk, and it is difficult to keep it out when once it is accustomed to get into a cellar where milk is kept. It has been seen taking milk out of the same dish with the children without biting them, though they often gave it blows with their spoons upon the head when it was too greedy. These snakes are, however, found extremely useful in America in clearing houses of rats, which they pursue with wonderful agility, even to the very roofs of barns and out-houses; for which good services they are cherished by the generality of the Americans, who are at great pains to preserve and multiply the breed. There are many species and varieties of this genus of serpents, which it would be tedious to enumerate. They are all indiscriminately called snakes or adders.—ED.

of this species is eleven inches. The eyes are red; the head small; the neck still more slender; from that part the body grows suddenly, and continues of an equal bulk to the tail, which ends quite blunt; the colour of the back is cinereous, marked with very small lines, composed of minute black specks; the sides are of a reddish cast; the belly dusky, and marked like the back. The motion of this serpent is slow; from which, and from the smallness of the eyes, are derived its names; some calling it the slow, and some the blind worm. Like all the rest of the kind in our climates, they lie torpid during winter; and are sometimes found in vast numbers, twisted together. This animal, like the former, is perfectly innocent; however, like the viper, it brings forth its young alive. Gesner tells us, that one of these being struck on the head when it was pregnant, it immediately cast forth its young.

The *Amphisbæna*, or the Double Headed serpent, is remarkable for moving along with either the head or the tail foremost; and from thence it has been thought to have two heads. This error took its rise from the thickness of the tail, which, at a distance, may be mistaken for another head.² Upon a nearer view, however, the error is easily discovered, and the animal will be found formed according to the usual course of nature. It is as thick at one end as at the other; and the colour of the skin is like that of the earth, being rough, hard, and variously spotted. Some have affirmed that its bite is dangerous; but this must be a mistake, as it wants the fangs, and, consequently, the elaboratory that prepares the poison.

These animals are only formidable from their similitude to the viper tribe. In some countries, where such reptiles are common, they make the distinction so exactly, that, while they destroy serpents of one kind with great animosity, they take others into their houses, and even into their bosoms, with a kind of unaccountable affection. The *Esculapian* serpent of Italy is among this number. It is there suffered to crawl about the chambers; and often gets into the beds where people lie. It is a yellow serpent, of about an ell long; and though innocent, yet will bite when

exasperated. They are said to be great destroyers of mice; and this may be the reason why they are taken under human protection. The *Boyuna* of Ceylon is equally a favourite among the natives; and they consider the meeting it as a sign of good luck. The *Surinam* serpent, which some improperly call the *Ammodytes*, is equally harmless and desirable among the savages of that part of the world. They consider themselves as extremely happy if this animal comes into their huts. The colours of this serpent are so many and beautiful, that they surpass all description; and these, perhaps, are the chief inducements to the savages to consider its visits as so very fortunate. A still greater favourite is the *Prince of Serpents*, a native of Japan, that has not its equal for beauty. The scales which cover the back are reddish, finely shaded, and marbled with large spots of irregular figures mixed with black. The fore part of the head is covered with large beautiful scales; the jaws bordered with yellow; the forehead marked with a black marbled streak; and the eyes handsome and lively. But, of all others the *Gerenda* of the East Indies is the most honoured and esteemed. To this animal, which is finely spotted with various colours, the natives of Calicut pay divine honours; and while their deity lies coiled up, which is its usual posture, the people fall upon their faces before it with stupid adoration. The African *Gerenda* is larger, and worshipped in the same manner by the inhabitants of the coast of *Mosambique*. The skin is not so finely spotted as the former; but it is variegated all over the body with very fine white, ash-coloured, and black spots. The brilliancy of colouring in these reptiles would only serve with us to increase our disgust; but in those countries where they are common, distinctions are made; and even in this horrid class there are some eyes that can discover beauty.

But in the larger tribe of serpents, there is nothing but danger to be apprehended. This formidable class, though without venom, have something frightful in their colour, as well as their size and form. They want that vivid hue with which the savages are so much pleased in the lesser kinds; they are all found of a dusky colour, with large teeth, which are more formidable than dangerous.

The first of this class is the great *Liboya* of Java and Brazil, which *Legaut* affirms he has seen fifty feet long. Nor is he singular in this report, as many of the missionaries affirm the same; and we have the concurrent testimony of historians as a further proof. The largest animal of this kind which has been brought into Europe, is but thirty-six feet long; and it is probable that much greater have been seen and destroyed before they were thought worth sending so far to satisfy European curiosity. The most usual length, however, of the *Liboya*, is about twenty feet, and the thickness in proportion.

² Goldsmith is in error here. Aristotle, *Ælian*, *Aldrovandus*, *Licetus*, *Lanzoni*, and many others, mention instances of serpents with double heads, so that it may be considered as a kind of structure not very uncommon in this tribe of animals. *Redi*, the celebrated anatomist, kept a two-headed snake for a considerable time, and afterwards dissected it. He found that it had two hearts, two tracheas, and two lungs: the two stomachs united into a common alimentary canal; and the liver and gall-bladder were double. He further remarks, that the one head died seven hours later than the other. Very lately *Dr. Corradori* at *Ruto* in *Tuscany* saw a snake with two heads; and adds, it sometimes happened that the heads differed as to the use of their faculties; thus the one head would eat while the other was asleep.—*Ed.*

The teeth are small in proportion to the body; nor are they used but when it seizes the smallest prey. It lies in wait for wild animals near the paths, and when it throws itself upon them, it wraps them round so closely as to break all the bones; then moistening the whole body over with its slaver, it makes it fit for deglutition, and swallows it whole.

The Boiguacu is supposed to be the next in magnitude, and has often been seen to swallow a goat whole. It is thickest in the middle of the body, and grows shorter and smaller towards the head and the tail: on the middle of the back there is a chain of small black spots running along the length of it; and on each side there are large, round, black spots, at some distance from each other, which are white in the centre: between these, near the belly, there are two rows of lesser black spots, which run parallel to the back. It has a double row of sharp teeth in each jaw, of a white colour, and shining like mother-of-pearl. The head is broad; and over the eyes it is raised into two prominences: near the extremity of the tail there are two claws, resembling those of birds.

These serpents lie hid in thickets, from whence they sally out unawares, and, raising themselves upright on their tails, will attack both men and beasts. They make a loud hissing noise when exasperated; and sometimes winding up trees, will dart down upon travellers, and twist themselves so closely round their bodies, as to despatch them in a very few minutes. Condamine, however, affirms that their bite is not dangerous; for though the teeth are so large as to inspire the beholder with terror, yet the wound they make is attended with no dangerous consequences whatever. Dellon affirms, that they generally haunt desert places; and though they are sometimes seen near great towns, or on the banks of rivers, yet it is generally after some great inundation; he never saw any but what were dead; and they appeared to him like the trunk of a great tree lying on the ground.

To this class of large serpents we may refer the Depona, a native of Mexico, with a very large head and great jaws. The mouth is armed with cutting crooked teeth, among which there are two longer than the rest, placed in the fore part of the upper jaw, but very different from the fangs of the viper. All round the mouth there is a broad scaly border; and the eyes are so large, that they give it a very terrible aspect. The forehead is covered with very large scales; on which are placed others that are smaller, curiously ranged: those on the back are grayish, and along it runs a double chain, whose ends are joined in the manner of a buckler. Each side of the belly is marbled with large square spots, of a chestnut colour, in the middle of which is a spot which is round and yellow. They avoid the sight of man; and, consequently, never do much harm.

Such are the most noted animals of the serpent tribe; but to recount all would be a vain, as well as a useless, endeavour. In those countries where they abound, their discriminations are so numerous, and their colours so various, that every thicket seems to produce a new animal. The same serpent is often found to bring forth animals of eight or ten different colours: and the naturalist who attempts to arrange them by that mark, will find that he has made distinctions which are entirely disowned by Nature: however, a very considerable number might be added to enlarge the catalogue; but having supplied a general history, the mind turns away from a subject, where every object presents something formidable or loathsome to the imagination. Indeed, the whole tribe resemble each other so nearly, that the history of one may almost serve for every other. They are all terrible to the imagination, all frightful to behold in their fury, and have long been considered as a race of animals, between whom and man there is a natural antipathy.

SUPPLEMENTARY NOTE.

The *Boa Constrictor* is the largest of the serpent race. Its ground colour is yellowish-gray, on which is distributed along the back, a series of large, chine-like, reddish-brown, and sometimes perfectly red variegations, with other smaller and more irregular marks and spots. They are readily distinguished from other serpents in the under surface of the tail being covered with scuta or divided plates, like those on their belly, and in their body not being terminated by a rattle. There are three species, natives of Africa, India, the larger Indian islands, and South America, where they chiefly reside in most retired situations in woods and marshy retreats.

We read in the 'Bombay Courier' of August 31st, 1799, that a Malay prow was making for the port of Amboyna, but the pilot finding that she could not enter it before dark, brought her to anchor for the night close under the island of Celebes. One of the crew went on shore in quest of betel nuts in the woods, and on his return lay down, as it is supposed, to sleep on the beach. In the course of the night he was heard by his comrades to scream out for assistance. They immediately went on shore, but it was too late; for an immense snake of this species had crushed him to death. The attention of the monster being entirely occupied by his prey, the people went boldly up to it, cut off its head, and took both it and the body of the man on board their boat. The snake had seized the poor fellow by the right wrist, where the marks of the fangs were very distinct; and the mangled corpse bore evident signs of being crushed by the monster's twisting itself round the neck, head, breast, and thigh. The length of the snake was about thirty feet; its thickness equal to that of a moderate-sized man; and on extending its jaws, they were found wide enough to admit at once a body of the size of a man's head.

Captain Stedman, when on board one of his boats on the river Cottica, in Surinam, was informed by one of his slaves, that a large snake was lying among the brushwood on the beach not far distant; and after some persuasion he was induced to land in order to shoot it. On the first shot, the ball, missing the head, went through the body, when the animal struck round, and with such astonishing force, as to cut away all the underwood around him with the

facility of a scythe mowing grass; and, by flouncing his tail, caused the mud and dirt in which he lay to fly to a considerable distance. They started back some way, but the snake was quiet again in a few minutes. Captain Stedman again fired, but with no better success than before; and the animal sent up such a cloud of dust and dirt as he had never seen but in a whirlwind, which caused them once more suddenly to retreat. After some persuasions he was induced, though much against his inclination, being exceedingly weak from illness, to make a third attempt. Having, therefore, once more discovered the snake, they discharged their pieces at once, and shot him through the head. The negro brought a boat-rope to draw him to the canoe, which was lying on the bank of the river. This proved no easy undertaking, since the huge creature, notwithstanding his being mortally wounded, still continued to writhe and twist about in such a manner as to render it dangerous for any person to approach him. The negro made a running noose on the rope, and after some fruitless attempts to make an approach, threw it over his head with much dexterity; and now, all taking hold of the rope, they dragged him to the beach, and tied him to the stern of the canoe to take him in tow. Being, however, still alive, he there kept swimming like an eel. The length of this animal, which the negroes declared to be only a young one, and but arrived at half its growth, was upwards of twenty-two feet; and its thickness about that of a boy near twelve years old, as was proved by measuring the creature's skin round the body of the boy that was with them. When they came to one of their stations, they hauled him on shore to skin him and take out the oil. To effect this purpose, one of the negroes having climbed up a tree with the end of a rope, let it down over a strong forked branch, and the others hoisted up the snake, and suspended him from the tree. This done, the former negro, with a sharp knife between his teeth, left the branch, and clung fast upon the monster, which was still writhing, and began his operation by ripping it up, and stripping down the skin as he descended. "Though I perceived (adds Captain Stedman) that it was no longer able to do him any

injury, I confess I could not, without emotion, see a man stark naked, black and bloody, clinging with his arms and legs round the slimy and yet living monster."

This labour, however, was not without its use, since he not only dexterously finished the operation, but saved from the animal above four gallons of fine clarified fat, or rather oil, which is of much use to the surgeons at hospitals: as much again as this was also supposed to have been wasted. The negroes cut the animal in pieces, and would have eaten it, had they not been refused the use of the kettle to boil it in.

The Anaconda is a name which, like that of the Boa Constrictor, has been popularly applied to all the larger and more powerful snakes. It appears to be of Ceylonese origin, and may therefore belong of right, as well as of usage, to the Indian species.

Happily the appetite of these gigantic snakes bears no proportion to their means of gratifying it, as a full meal is uniformly succeeded by a state of torpor, which frequently lasts for a month or six weeks, or, during the cold season, even for a longer period. Those in the tower of London, which are kept in a state of artificial warmth, usually feed about every five or six weeks, and a fowl or a rabbit generally suffices for a meal. These are held by the keeper within view of the serpent to ascertain whether he is inclined to take his prey or not. About three years ago Mr. Cops, while thus engaged in offering a fowl to one of the Boas, had nearly met with a serious accident; the snake, which was almost blind from the approaching change of its skin, missing the fowl, and seizing upon the keeper's thumb instead, around which and its own head it instantly threw two coils, and then, as if surprised at the unexpected resistance, cast an additional fold round his neck, and fixed itself by its tail to one of the posts of its cage in such a manner as nearly to throttle him. His own exertions, however, aided by those of the under-keepers, at length disengaged him from his perilous situation; but so determined was the attack of the snake that it could not be compelled to relinquish its hold until two of its teeth had been broken off and left in the thumb.

A HISTORY OF
THE EARTH AND ANIMATED NATURE.

PART SIXTH.
HISTORY OF ANIMATED NATURE.
OF INSECTS, ETC.

CONTENTS OF PART SIXTH.

Book I. Of Insects in General,	401
Book II. Insects of the Second Order,	421
Book III. Insects of the Third Order,	440
Book IV. Insects of the Fourth Order,	455
Book V. Of the Zoophytes,	487

HISTORY OF ANIMATED NATURE.

PART SIXTH.—OF INSECTS, ETC.

BOOK I.

INSECTS OF THE FIRST ORDER.

CHAP. I.

OF INSECTS IN GENERAL.

HAVING gone through the upper ranks of nature, we descend to that of insects; a subject almost inexhaustible, from the number of its tribes, and the variety of their appearance. Those who have professedly written on this subject, seem to consider it as one of the greatest that can occupy the human mind, as the most pleasing in animated nature.—“After an attentive examination,” says Swammerdam, “of the nature and anatomy of the smallest as well as the largest animals, I cannot help allowing the least an equal, or, perhaps, a superior degree of dignity. If, while we dissect with care the larger animals, we are filled with wonder at the elegant disposition of their parts; to what a height is our astonishment raised, when we discover all these parts arranged in the least in the same regular manner! Notwithstanding the smallness of ants, nothing hinders our preferring them to the largest animals; if we consider either their unwearied diligence, their wonderful strength, or their inimitable propensity to labour. Their amazing love to their young is still more unparalleled among the larger classes. They not only daily carry them to such places as may afford them food; but if, by accident, they are killed, and even cut into pieces, they, with the utmost tenderness, will carry them away, piecemeal, in their arms. Who can show such an example among the larger animals, which are dignified with the title of perfect! Who can find an instance in any other creature, that can come in competition with this!”

Such is the language of a man, who, by long study, became enamoured of his subject; but to those who judge less partially, it will be found that the insect tribe, for every reason, deserve but the last and lowest rank in animated nature. As in mechanics the most complicated machines are required to perform the nicest operations, so

in anatomy the noblest animals are most variously and wonderfully made.—Of all living beings, man offers the most wonderful variety in his internal conformation; quadrupeds come next, and other animals follow in proportion to their powers or their excellencies. Insects seem, of all others, the most imperfectly formed: from their minuteness, the dissecting knife can go but a short way in the investigation; but one thing argues an evident imperfection, which is, that many of them can live a long time, though deprived of those organs which are necessary to life in the higher ranks of nature. Many of them are furnished with lungs and a heart, like nobler animals; yet the caterpillar continues to live, though its heart and lungs, which is often the case, are entirely eaten away.¹

But it is not from their conformation alone, that insects are inferior to other animals, but from their instincts also. It is true that the ant and the bee present us with very striking instances of assiduity; but how far are theirs beneath the mark of sagacity exhibited in the hound or the stag! A bee, taken from the swarm, is totally helpless and inactive, incapable of giving the smallest variation to its instincts: it has but one single method of operating, and, if put from that, it can turn to no other. In the pursuits of the hound, there is something like a

¹ A very interesting fact respecting the difference of irritability of insects from that of the higher animals, is this: the temperature of man and the mammalia is in health always the same, and varies very inconsiderably in disease. External heat and external cold do not produce a blood, in man, warmer at the equator than at the pole. This is not the case with insects, whose mean temperature may be about 80°; but the thermometer inserted into their bodies may be made to rise or fall by bringing any cold or warm body in contact with their external surface. You may thus sink the temperature of an insect to 50° or raise it to 100°, and the insect continue alive. This is a very curious fact, and shows the inaccuracy of Hunter's description or definition of *life*.—“That it was that which resisted the physical agency of cold and heat.”—Ed.

choice; in the labours of the bee, the whole appears like necessity or compulsion.

If insects be considered as bearing a relation to man, and as assisting him in the pleasures or necessities of life, they will, even in this respect, sink in the comparison with the larger tribes of nature. It is true that the bee, the silk-worm, the cochineal fly, and the cantharides, render him signal services; but how many others of this class are either noxious or totally unserviceable to him? Even in a country like ours, where all the noxious animals have been reduced by repeated assiduity, the insect tribes still maintain their ground, and are but too often unwelcome intruders upon the fruits of human industry. But in more uncultivated regions, their annoyance and devastations are terrible. What an uncomfortable life must the natives lead in Lapland, and some parts of America, where, if a candle be lighted, the insects swarm in such abundance, as instantly to extinguish it with their numbers; where the inhabitants are obliged to smear their bodies and their faces with tar, or some other composition, to protect them from the puncture of their minute enemies; where, though millions are destroyed, famished millions are still seen to succeed, and to make the torture endless!

Their amazing number is also an argument of their imperfection. It is a rule that obtains through all nature, that the nobler animals are slowly produced, and that nature acts with a kind of dignified economy; but the meaner births are lavished in profusion, and thousands are brought forth merely to supply the necessities of the more favourite objects of creation. Of all other productions in nature, insects are the most numerous. Vegetables that cover the surface of the earth, bear no proportion to their multitudes; and though, at first sight, herbs of the field seem to be the parts of organized nature produced in the greatest abundance, yet, upon minuter inspection, we shall find every plant supporting a number of scarcely perceptible creatures, that fill up the various stages of youth, vigour, and age, in the compass of a few days' existence.

All other animals are capable of some degree of education; their instincts may be suppressed or altered: the dog may be taught to fetch and carry; the bird to whistle a tune; and the serpent to dance: but the insect has but one invariable method of operating; no arts can turn it from its instincts; and, indeed, its life is too short for instruction, as a single season often terminates its existence.

For these reasons, the insect tribe are deservedly placed in the lowest rank of animated nature; and, in general, they seem more allied to the vegetables on which they feed, than to the nobler classes above them. Many of them are attached to one vegetable, often to a single leaf; there they increase with the flourishing plant, and die as it decays; a few days fill up the mea-

sure of their contemptible lives; while the ends for which they were produced, or the pleasures they enjoyed, to us at least, are utterly unknown.

Yet while I am thus fixing the rank of a certain class of animals, it seems necessary to define the nature of those animals which are thus degraded. Definitions in general produce little knowledge; but here, where the shades of nature are so intimately blended, some discrimination is necessary to prevent confusion. The smallness of the animal, for instance, does not constitute an insect; for then, many of the lizard kind, which are not above two inches long, would come under this denomination; and if the smaller lizards, why not the crocodile? which would be a terrible insect indeed! In the same manner, smallness, with a slow creeping motion, does not constitute an insect; for, though snails might be called insects, with the same propriety the whole tribe of sea shell-fish would then have equal pretensions; and a very troublesome innovation would be brought into our language, which is already formed. Excluding such animals, therefore, from the insect tribe, we may define insects to be *little animals without red blood, bones, or cartilages, furnished with a trunk, or else a mouth, opening lengthwise, with eyes which they are incapable of covering, and with lungs which have their opening on the sides.* This definition comprehends the whole class of insects, whether with or without wings; whether in their caterpillar or butterfly state; whether produced in the ordinary method of generation between male and female, or from an animal that is itself both male and female, or from the same animal cut into several parts, and each part producing a perfect animal.

From hence it appears, that in this class of animals there are numerous distinctions, and that a general description will by no means serve for all. Almost every species has its own distinct history; and exhibits manners, appetites, and modes of propagation, peculiarly its own. In the larger ranks of existence, two animals that nearly resemble each other in form, will be found to have a similar history; but here insects almost entirely alike, will be found perfectly dissimilar, as well in their manner of bringing forth and subsisting, as in the changes which they undergo during their short lives. Thus, as this class is prolific beyond computation, so are its varieties multiplied beyond the power of description. The attempt to enumerate all the species of a fly or a moth would be very fruitless; but to give a history of all would be utterly impracticable: so various are the appetites, the manners, and the lives of this humble class of beings, that every species requires its distinct history. An exact plan, therefore, of Nature's operations in this minute set of creatures, is not to be expected; and yet such a general picture may be given, as is sufficient to show the protection which Providence affords its smallest as well as its largest

productions, and to display that admirable circulation in nature by which one set of living beings find subsistence from the destruction of another; and by which life is continued without a pause in every part of the creation.

Upon casting a slight view over the whole insect tribe, just when they are supposed to rouse from their state of annual torpidity, when they begin to feel the genial influence of spring, and again exhibit new life in every part of nature, their numbers and their varieties seem to exceed all powers of calculation, and they are indeed too great for description. When we look closer, however, we shall find some striking similitudes, either in their propagation, their manners, or their form, that give us a hint for grouping several of them into one description, and thus enabling us to shorten the labour of a separate history for every species. Swammerdam, Reaumur, and Linnaeus, have each attempted to abridge the task of description, by throwing a number of similar animals into distinct classes, and thus making one general history stand for all. I will avail myself of their labours; and uniting their general distinctions, throw the whole class of insects into four separate distributions, giving under each the history of every species that seems to me considerable enough to deserve our notice. Thus our labour will be shortened; and the very rank in which an insect is placed, will, in some measure, exhibit a considerable part of its history.

In our cursory inspection of the insect tribe, the first animals that offer themselves are those which want wings, that appear crawling about on every plant, and on every spot of earth we regard with any degree of attention. Of these, some never obtain wings at any period of their existence; but are destined to creep on the vegetable, or the spot of earth, where they are stationed, for their whole lives. On the contrary, others are only candidates for a more happy situation; and only wait their growing wings, when they may be said to arrive at their state of full perfection.

Those that never have wings, but creep about till they die, may be considered as constituting the first class of insects. All these, the flea and the woodlouse only excepted, are produced from an egg; and when once they break the shell, they never suffer any further change of form, but continue to grow larger till they die. Thus the louse or the spider are produced from an egg, never suffering any alteration when once they are excluded; but, like the chicken or the duck, remaining invariably the same, from their birth to their dissolution.

The second order of insects consists of such as have wings; but which, when produced from the egg, have those wings cased up in such a manner as not to appear. This casing up of the wings, however, does not prevent the animal's running, leaping, and moving with its natural

celerity; but when the case bursts, and the wings have a power of expanding, all the animal's motions become more extensive, and the animal arrives at full perfection. Thus the grasshopper, the dragon-fly, and the ear-wig, have their wings at first bound down; but when the skin, that, like a pair of stays, kept them confined, bursts, they are then expanded, and the animal pursues the purposes for which it was produced.

The third order of insects is of the moth and butterfly kind. These all have four wings, each covered with a mealy substance of various colours, which when handled comes off upon the fingers; and, if examined by the microscope, will appear like scales, with which the wing is nicely embroidered all over. These insects also are produced in a manner peculiar to themselves. They are at first hatched from an egg, from whence proceeds a caterpillar that eats, and often casts its skin; the caterpillar having divested itself for the last time, assumes a new covering, which is called a chrysalis, or the cone in the silkworm, in which it continues hidden till it come forth a perfect moth, or butterfly.

The fourth order is of those winged insects which come from a worm instead of a caterpillar, and yet go through changes similar to those which moths and butterflies are seen to undergo. They are first excluded from the egg as a worm, and then become a chrysalis; in some, their wings and legs are seen; in others, the animal is quite detached from the cone in which it is concealed; but all at length break their prison and come out perfect winged animals; some furnished with two wings, and some with four. The wings of all these differ from those of the butterfly and moth kind, by not having the mealy scales which are ever found on the wings of the former. In this class we may place the numerous tribes of gnats, beetles, bees, and flies.

To these I will add, as a fifth order, a numerous tribe lately discovered, to which naturalists have given the name of Zoophytes. These do not go through the ordinary forms of generation, but may be propagated by dissection. Some of these, though cut into a hundred parts, still retain life in each, and are endued with such a vivacious principle, that every part will in a short time become a perfect animal. They seem a set of creatures placed between animals and vegetables, and make the shade that connects animated and insensible nature. To this class belong the polypus, the earth-worm, and all the varieties of the sea-nettle.

Having thus given a general distribution of insects, I will proceed to describe each class in the order I have mentioned them; beginning with insects without wings, as they more nearly resemble the higher ranks of nature, as well in their habits as their conformation.

SUPPLEMENTARY NOTE.

The insect division of the animal kingdom received its name from the individuals of which it is composed having a separation in the middle of their bodies, by which they are cut, as it were, into two parts; these parts are in general connected by a slender ligament, or hollow thread.

Insects breathe through pores arranged along their sides; the crab and lobster tribes form an exception to this rule, for they respire by means of gills, and have a head or bony skin, and many feet. The greater part of them are furnished with wings. They are destitute of brain, nostrils, and eyelids. Not only the place of the liver, but of all the secretory glands, is in them supplied by long vessels that float in the abdomen. The mouth is, in general, situated under the head; and is furnished with transverse jaws, with lips, a kind of teeth, a tongue, and palate: it has also, in most instances, four or six palpi, or feelers. Insects have also moveable antennæ proceeding generally from the front part of the head, which are endowed with a very nice sense of feeling.

In a minute examination that has been lately made in this class by Cuvier, one of the most accurate observers of nature now living, neither a heart nor arteries have been detected; and this gentleman says, that the whole organization of insects is such as one would expect to find, if they had been actually known not to be provided with such organs. Their nutrition, therefore, would seem to be carried on by immediate absorption, as is evidently the case with the polypes and other zoophytes.

Nearly all insects except spiders, and a few others of the apterous tribe, which proceed nearly in a perfect state from the egg, undergo a metamorphosis, or change, at three different periods of their existence.

The lives of these minute creatures in their perfect state are in general so short, that the parents seldom have an opportunity of seeing their living offspring. Consequently they are neither provided with milk, like viviparous animals, nor are they, like birds, impelled to sit upon their eggs, to bring their young to perfection. In place of these, the all-directing Power has endowed each species with the astonishing faculty of being able to discover what substance is fitted to afford the food proper for its young; though such food is, for the most part, so totally different from that which the parent itself could eat, that, in many cases, it would prove a deadly poison to it. Some of them attach their eggs to the bark, or insert them in the leaves of trees and other vegetable substances; others form nests, which they store with insects or caterpillars, that will attain the exact state in which they are proper food for their young, when they shall awaken into life; others bury their eggs in the bodies of other insects; and others, again, adopt very surprising methods of conveying them into the body, and even into the internal viscera of larger animals. Some drop their eggs into the water, an element in which they would soon be destroyed. In short, the variety of contrivances that are adopted by insects to insure the subsistence of their young are beyond enumeration.

From the eggs of all insects proceed what is called *larvæ*, grubs, or caterpillars. These consist of a long body, covered with a soft tender skin, divided into segments or rings. The motions of many of the larvæ are performed on these rings only, either in the manner of serpents, or by resting alternately each segment of the body on the plane which supports it. Such is the motion of the larvæ of the flies, emphatically so called, and of the wasps and bees. Sometimes the surfaces of the rings are covered with spines, stiff bristles, or hooks: this is the case in gad-

flies, crane-flies, and some others. The bodies of the larvæ, in some orders of insects, have, towards the head, six feet, each formed of three small joints; the last of which is scaly, and terminates in a hook: this is usual in those of beetles and dragon-flies. The larvæ of butterflies and moths, besides six feet, which are not jointed, but terminate in hooks disposed in circles and semicircles; these hooks, which are attached to the skin by a kind of retractile tubercles, serve as cramps to assist their motion on other bodies. The larvæ of such insects as undergo only a semi-metamorphosis, as the crickets, cockroaches, and others of the order of hemiptera, and those of the insects that have no transformation, as in the aptera, (the flea excepted,) differ in nothing, with respect to their feet, from the perfect insects.—In this larvæ state, many insects remain for months, others for a year, and some for even two or three years. They are in general extremely voracious, oftentimes devouring more than their own weight in twenty-four hours.

As soon as their parts become perfected, and they are prepared to appear under a new form, in a pupa or chrysalis, they fix upon some convenient place where they are least exposed to danger, for the performance of the arduous operation. This is essentially necessary, since in their transformation they have neither strength to resist, nor swiftness to avoid the attacks of an enemy. That Power, which instructed the parents to deposit their eggs in a proper receptacle, at this critical period directs their offspring in the most secure and appropriate situation for their future defenceless state. Some of them spin webs or cones, in which they enclose themselves; others undergo their change in decayed wood; and others conceal themselves under the surface of the earth.—Preparatory to the transformation, the larvæ cease to take any food, and for some days continue in a state of inactivity. During this time the internal organs gradually unfold themselves. When the completion is at hand, many of them may be observed alternately to extend and contract their bodies, in order to disengage themselves from the caterpillar skin. The hinder parts are those first liberated: when this is done, the animals contract, and draw the skin up towards their head; and by strong efforts, soon afterwards put it entirely off. In their chrysalis state they remain for some time to all appearance perfectly inanimate; but this is only in appearance, for on being taken into the hand, they will always be found to exhibit signs of life. It is singular, that, in the changes of insects, the intestinal canal is frequently different in the same individuals, as they pass through the three states.

As soon as the parts of the animal, within the shell of the chrysalis, have acquired sufficient strength to break the bonds that surround it, the little creature exerts its powers, and appears to the world in its perfect state; for a little while it appears humid and weak, but as the humidity evaporates, its wings and shell become hardened, and it soon afterwards commits itself in safety to its new element.

Some writers have conjectured that the *antennæ*, or horns of insects, were their organs of hearing; for it is evident, from various experiments, that insects are possessed of this sense in a degree as exquisite as most other animals, although, from their minuteness, we perhaps may never discover by what means. The *antennæ*, however, seem little likely to answer the purpose of ears. These instruments, of apparently exquisite sensibility, appear adapted to very different purposes, but to purposes with which we may remain long unacquainted.

The eyes are formed of a transparent crustaceous set of lenses, so hard as to require no coverings to protect them. These, like multiplying glasses, have innumerable surfaces, on every one of which the ob-

jects are distinctly formed; so that, if a candle is held opposite to them, it appears multiplied almost to infinity on their surfaces. Other creatures are obliged to turn their eyes; but insects have some or other of these lenses directed towards objects, from what quarter soever they present themselves. All these minute hemispheres are real eyes, through which everything appears topsy-turvy. Leeuwenhoek looked through the eye of a dragon-fly (with the help of a microscope) as a telescope, and viewed the steeple of a church, which was 299 feet high, and 750 from the place; he could plainly see the steeple, though not apparently larger than the point of a fine needle. He also viewed a house, and could discern the front, distinguish the doors and windows, and perceive whether the windows were open or shut. Mr. Hook computed that there were 14,000 of these lenses in the two eyes of a drone; and Mr. Leeuwenhoek reckons 12,544 lenses in each eye of the dragon-fly. The pictures of objects, therefore, that are delineated on these, must be millions of times less than those formed on the human eye. Many insects still smaller have eyes, no doubt contrived so as to discern objects some thousands of times less than themselves; for such the minute particles on which they feed must certainly be. In some coleopterous or scaly-winged insects there have been numbered no less than 28,088 of these lenses.

With respect to the wings of insects, those of the two first orders of Linnæus have theirs defended by a pair of crustaceous cases called *elytra*. The three subsequent orders have four membranaceous wings without *elytra*. All the insects of the sixth order have but two wings, and under each of these, at its base, there is a poise or balancer like a little knob. These poises are commonly little balls, placed on the top of a slender stalk, and moveable every way at pleasure. In some they stand alone; but in others, as in the whole flesh-fly tribe, they have little covers, or hollow membranaceous scales, each of which somewhat resembles a spoon without a handle: every time the insect strikes the air with its wings, a very quick motion may be perceived in the balancer; and in the flesh-flies, when this moves, it strikes against the little scale, and this assists in producing the well known buzzing sound that is made by flies when on the wing. The use of the balancer to an insect, seems to be precisely the same as that of a long pole, loaded at each end with lead, is to a rope-dancer: they render the body steady, and obviate all its vacillations in flight.

The structure of the feet of these diminutive creatures is truly admirable. Those insects that live altogether in water have their feet long, flat, and somewhat hairy at the edges, well adapted to aid their motions in that element. Such as have occasion to burrow into the earth have their legs broad, sharp-edged, and serrated. Those that use their feet only in walking have them long, and cylindrical; some of the feet are furnished with sharp hooked claws, and skinny palms by which, from the pressure of the atmosphere upon them, the insects are enabled to walk on glass and other smooth surfaces, even with their backs downwards, as in various species of flies: others have somewhat like sponges, that answer the same end: and the spider has each foot armed with a comb, probably for the purpose of separating the six threads that issue from so many orifices of its body, and preventing them from tangling. In the hind-legs of insects which have occasionally to pass over spaces by leaping, the thigh is peculiarly large and thick.

The tongue of insects is a taper and compact instrument, by which they suck their food. Some of the animals can contract, or expand it; and others, as the butterflies, roll it up under their head, somewhat like the spring of a watch. In many it is en-

closed within a sheath; and in several, as the flies, it is fleshy and tubular.

The mouth is generally placed somewhat underneath the front part of the head; but in a few of the tribes is situated below the breast. Some insects have it furnished with a kind of forceps, for the purpose of seizing and cutting their prey; and in others it is pointed, to pierce animal and vegetable substances, and suck their juices. In several it is strongly ridged with jaws and teeth, to gnaw and scrape their food, carry burdens, perforate the earth, nay, the hardest woods, and even stones, for habitations and nests for their young. In a few the tongue is so short, as to appear to us incapable of answering the purpose for which it was formed; and the gad-flies appear to have no mouth.

Near the mouth is situated the *palpi*, or feelers. these are generally four, but sometimes six in number. They are a kind of thread-shaped, articulated antennæ. Their situation, under and at the sides of the mouth, renders them, however, sufficiently distinct from the proper antennæ. They are in continual motion, in consequence of the little animals' thrusting them into everything likely to afford them food. Some writers have considered them as serving the place of a hand, in holding food to the mouth while the insects are eating.

CHAP. II.

OF INSECTS WITHOUT WINGS.

EVERY moment's observation furnishes us with instances of insects without wings; but the difficulty is to distinguish those which are condemned continually to lead reptile lives, from such as only wait the happy moment of transmutation. For this, nothing but a long and intimate acquaintance will suffice; but, in general, all animals resembling the flea, the louse, the spider, the bug, the wood-louse, the water-louse, and the scorpion, never acquire wings, but are produced from the egg in that form which they never change afterwards.

If we consider this class as distinct from others, we shall find them in general longer lived than the rest, and often continuing their term beyond one season, which is the ordinary period of an insect's existence. They seem also less subject to the influence of the weather; and often endure the rigours of winter without being numbed into torpidity. The whole race of moths, butterflies, bees, and flies, are rendered lifeless by the return of cold weather; but we need not be told, that the louse, the flea, and many of these wingless creatures, that seem formed to tease mankind, continue their painful depredations the whole year round.

They come to perfection in the egg, as was said before; and it sometimes happens, that when the animal is interrupted in performing the offices of exclusion, the young ones burst the shell within the parent's body, and are thus brought forth alive. This not unfrequently happens with the wood-louse, and others of the kind, which are

sometimes seen producing eggs, and sometimes young ones perfectly formed.

Though these creatures are perfect from the beginning, yet they are often during their existence seen to change their skin; this is a faculty which they possess in common with many of the higher ranks of animals, and which answers the same purposes. However tender their skins may seem to the feel, yet, if compared to the animal's strength and size, they will be found to resemble a coat of mail, or, to talk more closely, the shell of a lobster. By this skin these animals are defended from accidental injuries, and particularly from the attacks of each other. Within this they continue to grow, till their bodies become so large as to be imprisoned in their own covering, and then the shell bursts, but is quickly replaced by a new one.

Lastly, these animals are endued with a degree of strength, for their size, that at first might exceed credibility. Had man an equal degree of strength, bulk for bulk, with a louse or flea, the history of Samson would be no longer miraculous. A flea will draw a chain a hundred times heavier than itself; and to compensate for this force, will eat ten times its own size of provision in a single day.

CHAP. III.

OF THE SPIDER, AND ITS VARIETIES.

THE animal that deserves our first notice in this principal order of insects is the spider,¹ whose manners are of all others the most subtle, and whose instincts are most various. Formed for a life of rapacity, and incapable of living upon any other than insect food, all its habits are calculated to deceive and surprise: it spreads toils to entangle its prey; it is endued with patience to expect its coming; and is possessed of arms and strength to destroy it when fallen into the snare.

In this country, where all the insect tribes are kept under by human assiduity, the spiders are but small and harmless. We are acquainted with few but the house-spider, which weaves its web in neglected rooms; the garden-spider, that spreads its toils from tree to tree, and rests in the centre; the wandering spider, that has no abode like the rest; and the field-spider, that is sometimes seen mounting, web and all, into the clouds. These are the chief of our native spiders; which, though reputed venomous, are en-

tirely inoffensive. But they form a much more terrible tribe in Africa and America. In those regions, where all the insect species acquire their greatest growth, where the butterfly is seen to spread a wing as broad as our sparrow, and the ant to build a habitation as tall as a man, it is not to be wondered at that the spiders are seen bearing a proportionable magnitude. In fact, the bottom of the Martinico's spider's body is as large as a hen's egg, and covered all over with hair. Its web is strong, and its bite dangerous. It is happy for us, however, that we are placed at a distance from these formidable creatures, and that we can examine their history without feeling their resentment.

Every spider has two divisions in its body. The fore part, containing the head and breast, is separated from the hinder part or belly by a very slender thread, through which, however, there is a communication from one part to the other. The fore part is covered with a hard shell, as well as the legs, which adhere to the breast. The hinder part is clothed with a supple skin, beset all over with hair. They have several eyes all round the head, brilliant and acute; these are sometimes eight in number, sometimes but six; two behind, two before, and the rest on each side. Like all other insects, their eyes are immoveable, and they want eye-lids; but this organ is fortified with a transparent horny substance, which at once secures and assists their vision. As the animal procures its subsistence by the most watchful attention, so large a number of eyes was necessary to give it the earliest information of the capture of its prey. They have two pincers on the fore part of the head, rough, with strong points, toothed like a saw, and terminating in claws, like those of a cat. A little below the point of the claw there is a small hole, through which the animal emits a poison, which, though harmless to us, is sufficiently capable of destroying its prey. This is the most powerful weapon they have against their enemies; they can open or extend these pincers as occasion may require; and when they are undisturbed, they suffer them to lie one upon the other, never opening them but when there is a necessity for their exertion. They have all eight legs, jointed like those of lobsters; and similar also in another respect; for if a leg be torn away, or a joint cut off, a new one will quickly grow in its place, and the animal will find itself fitted for combat as before. At the end of each leg there are three crooked moveable claws, namely, a small one, placed higher up, like a cock's spur, by the assistance of which it adheres to the threads of its web. There are two others larger, which meet together like a lobster's claw, by which they can catch hold of the smallest depressions, walking up or down the very polished surfaces, on which they can find inequalities that are imperceptible to our grosser sight. But when they walk upon such bodies as

¹ Modern naturalists (says Mr. Rennie in his work on Insect Architecture) do not rank spiders among insects, because they have no antennæ, and no division between the head and the shoulders; they breathe by leaf-shaped gills, situated under the belly, instead of spiracles in the sides; have a heart connected with these; have eight legs instead of six; and eight fixed eyes.—ED.

are perfectly smooth, as looking-glass or polished marble, they squeeze a little sponge, which grows near the extremity of their claws, and thus diffusing a glutinous substance, adhere to the surface until they make a second step. Besides the eight legs just mentioned, these animals have two others, which may more properly be called arms, as they do not serve to assist motion, but are used in holding and managing their prey.

The spider, though thus formidably equipped, would seldom prove successful in the capture, were it not equally furnished with other instruments to assist its depredations. As it lives wholly upon flies, and is without wings to pursue them, it is obvious they must for ever escape so impotent an adversary; but the spider is a most experienced hunter, and spreads its nets to catch those animals it is unable to pursue. The spider's web is generally laid in those places where flies are most apt to come and shelter; in the corners of rooms, round the edges of windows, and in the open air among the branches of trees. There the little animal remains for days, nay, weeks together, in patient expectation, seldom changing its situation though never so unsuccessful.

For the purposes of making this web, nature has supplied this animal with a large quantity of glutinous matter within its body, and five dugs or teats for spinning it into thread. This substance is contained in a little bag, and at first sight it resembles soft glue; but when examined more accurately, it will be found twisted into coils of an agate colour, and upon breaking it, the contents may be easily drawn out into threads, from the tenacity of the substance, not from those threads being already formed. Those who have seen the machine by which wire is spun, will have an idea of the manner in which this animal forms the thread of its little net, the orifices of the five teats above-mentioned, through which the thread is drawn, contracting or dilating at pleasure. The threads which we see, and appear so fine, are, notwithstanding, composed of five joined together, and these are many times doubled when the web is in formation.

When the house-spider purposes to begin a web, it first makes choice of some commodious spot, where there is an appearance of plunder and security. The animal then distils one little drop of its glutinous liquor, which is very tenacious, and then creeping up the wall, and joining its thread as it proceeds, it darts itself in a very surprising manner, as I have often seen, to the opposite place, where the other end of the web is to be fastened.² The first thread thus formed,

drawn tight, and fixed at each end, the spider then runs upon it backward and forward, still assiduously employed in doubling and strengthening it, as upon its force depends the strength and stability of the whole. The scaffolding thus completed, the spider makes a number of threads parallel to the first, in the same manner, and then crosses them with others; the clammy substance of which they are formed, serving to bind them, when newly made, to each other. The insect, after this operation, doubles and trebles the thread that borders its web, by opening all its teats at once, and secures the edges, so as to prevent the wind from blowing the work away. The edges being thus fortified, the retreat is next to be attended to; and this is formed like a funnel at the bottom of the web, where the little creature lies concealed. To this are two passages, or outlets, one above and the other below, very artfully contrived, to give the animal an opportunity of making excursions at proper seasons, of prying into every corner, and cleaning those parts which are observed to be clogged or encumbered. Still attentive to its web, the spider, from time to time, cleans away the dust that gathers round it, which might otherwise clog and incommode it: for this purpose, it gives the whole a shake with its paws; still, however, proportioning the blow as not to endanger the fabric. It often happens, also, that from the main web there are several threads extended at some distance on every side; these are, in some measure, the outworks of the fortification, which, whenever touched from without, the spider prepares for attack or self-defence. If the insect impinging be a fly, it springs forward with great agility; if, on the contrary, it be the assault of an enemy stronger than itself, it keeps within its fortress, and never ventures out till the danger be over. Another advantage the spider reaps from this contrivance of a cell or retreat behind the web, is, that it serves for a place where the creature can feast upon its game with all safety, and conceal the fragments of those carcasses it has picked, without exposing to public view the least trace of barbarity, that might create a suspicion in any insects that their enemy was near.

proceeds, it "*darts itself to the opposite side, where the other end is to be fastened!*" Homberg's spider took the more circuitous route of travelling to the opposite wall, carrying in one of the claws the end of the thread previously fixed, lest it should stick in the wrong place. This we believe to be the correct statement, for as the web is always horizontal, it would seldom answer to commit a floating thread to the wind, as is done by other species. Homberg's spider, after stretching as many lines by way of *warp*, as it deemed sufficient between the two walls of the corner which it had chosen, proceeded to cross this in the way our weavers do in adding the *woof*, with this difference, that the spider's threads were only laid on and not interlaced. The domestic spiders, however, in these modern days, must have forgot this mode of weaving, for none of their webs will be found to be thus regularly constructed.—ED.

² The house-spider's proceedings were long ago described by Homberg, and the account has been copied, as usual, by almost every subsequent writer. Goldsmith has, indeed, given some strange mis-statements from his own observations, and Bingley has added the original remark, that, after fixing its first thread, creeping along the wall and joining it as it

It often happens, however, that the wind, or rustling of the branches, or the approach of some large animal, destroys in a minute the labours of an age. In this case, the spider is obliged to remain a patient spectator of the universal ruin; and when the danger is passed away, it sets about repairing the calamity. For this purpose, it is furnished with a large store of the glutinous substance of which the web is made; and with this, it either makes a new web, or patches up the old one. In general, however, the animal is much fonder of mending than making, as it is furnished originally with but a certain quantity of glutinous matter, which when exhausted, nothing can renew. The time seldom fails to come, when their reservoirs are entirely dried up, and the poor animal is left to all the chances of irretrievable necessity. An old spider is thus frequently reduced to the greatest extremity; its web is destroyed, and it wants the materials to make a new one. But as these animals have been long accustomed to a life of shifting, it hunts about to find out a web of another spider, younger and weaker than itself, with whom it ventures a battle. The invader generally succeeds; the younger one is driven out to make a new web, and the old one remains in quiet possession. If, however, the spider is unable to dispossess any other of its web, it then endeavours, for a while, to subsist on accidental depredation; but in two or three months it inevitably dies of hunger.³

³ From its having been frequently remarked that spiders spread their webs in solitary and confined places, to which it is difficult for flies to penetrate, M. de Vaillant naturally concluded that these creatures must often remain long without food, and that consequently they were capable of enduring considerable abstinence. To ascertain the truth of this circumstance, he took a large garden spider, whose belly was about the size of a nut, and enclosed it under a glass bell, which he secured with cement round its bottom, and left it in that situation for ten months. Notwithstanding this deprivation of food, it appeared during the whole time equally vigorous and alert; but its belly decreased, till at last it was scarcely larger than the head of a pin. He then put under the bell to it another spider of the same species. For a little while they kept at a respectful distance from each other, and remained motionless, but presently the meagre one, pressed by hunger, approached and attacked the stranger. It returned several times to the charge; and, in these different conflicts, its enemy became deprived of almost all its claws: it carried these away, and retired to its former situation to devour them. The meagre one had likewise lost three of its own claws, on which also it fed; and M. de Vaillant perceived that, by this repast its plumpness was in some measure restored. The day following the new comer, deprived of all its means of defence, fell a complete sacrifice. It was speedily devoured; and in less than twenty-four hours, the old inhabitant of the bell became as plump as it was at the first moment of its confinement. When two spiders of the same size meet in combat, neither of them will yield: they hold each other by the fangs so fast, that in general one of the two must die before they are separated. M. Leeuwenhoek says, he saw one spider that was, however,

The garden-spider seems to work in a different manner. The method with this insect is, to spin a great quantity of thread, which floating in the air in various directions, happens from its glutinous quality, at last to stick to some object near it, a lofty plant or the branch of a tree. The spider only wants to have one end of the line fast, in order to secure and tighten the other. It accordingly draws the line when thus fixed, and then, by passing and repassing upon it, strengthens the thread in such a manner as to answer all its intentions. The first cord being thus stretched, the spider walks along a part of it, and there fastens another, and dropping from thence, fastens the thread to some solid body below, then climbs up again and begins a third, which it fastens by the same contrivance. When three threads are thus fixed, it forms a square, or something that very nearly resembles one, and in this the animal is generally seen to reside. It often happens, however, when the young spider begins spinning, that its web becomes too buoyant, and not only the thread floats in the air, but even the little spinster. In this manner we have often seen the threads of spiders floating in the air; and what is still more surprising, the young spiders themselves attached to their own web. The reason is obvious; for as even gold itself may be so finely drawn out as to float in the air, so the finer thread of a spider is so buoyant as not only to swim in the air, but also to lift the spider itself; which, like the tail of a kite, rises with its own manufacture.⁴

only wounded in one leg by his antagonist. A drop of blood as large as a grain of sand issued from the sore; and not being able to use this wounded leg in running away from his adversary, he held it up, and presently afterwards the whole limb dropped away from his body. When spiders are wounded in the breast, or upper parts of the body, they always die.

The spider, the ptinus, and many insects of the beetle kind, exhibit an instinct of a very extraordinary nature. When put in terror by a touch of the finger, the spider runs off with great swiftness; but if he finds in whatever direction he takes he is opposed by another finger, he then seems to despair of being able to escape, contracts his limbs and body, lies perfectly motionless, and counterfeits every symptom of death. "In this situation," says Smellie, "I have pierced spiders with pins, and torn them to pieces, without their discovering the smallest marks of pain. This simulation of death has been ascribed to a strong convulsion, or stupor, occasioned by terror. But this solution of the phenomenon is erroneous. I have repeatedly tried the experiment, and uniformly found, that, if the object of terror be removed, in a few seconds the animal runs off with the greatest rapidity. Some beetles, when counterfeiting death, will suffer themselves to be gradually roasted without moving a single joint."—ED.

⁴ The power of certain spiders to make long aerial voyages must be pretty generally known, but seldom has it been more strikingly illustrated than in the following interesting narrative of a recent intelligent traveller. "One day," says Dr. Darwin, "the weather having been fine and clear, the air was full of patches of the flocculent gossamer web, as on an autumnal day in England. The ship was 60 leagues distant from the land, in the direction of a steady

The spider's web being thus completed, and fixed in a proper place, its next care is to seize and secure whatever insect happens to be caught in the toil. For this purpose, it remains for weeks, and even months, upon the watch, without ever catching a single fly; for the spider, like most other insects, is surprisingly patient of hunger. It sometimes happens that too strong a fly strikes itself against the web, and thus, instead of being caught, tears the net to pieces. In general, however, the butterfly or the hornet, when they touch the web, fly off again, and the spider seems no way disposed to interrupt their retreat. The large blue-bottle-fly, the ichneumon-fly, and the common meat-fly, seem to be its favourite game. When one of these strikes into the toils, the spider is instantly seen alert and watchful at the mouth of its hole, careful to observe whether the fly be completely immeshed; if that be the case, the spider walks leisurely forward, seizes its prey, and instantly kills it by instilling a venomous juice into the wound it makes. If, however, the fly be not entirely immeshed, the spider patiently waits, without ap-

though light breeze. Vast numbers of a small spider, about one-tenth of an inch in length, and of a dusky red colour, were attached to the webs. There must have been, I should suppose, some thousands on the ship. The little spider, when first coming in contact with the rigging, was always seated on a single thread, and not on the flocculent mass. This latter seems merely to be produced by the entanglement of the single threads. The spiders were all of one species, but of both sexes, together with young ones. The little *aéronaut*, as soon as it arrived on board, was very active, running about; sometimes letting itself fall, and then reascending the same thread; sometimes employing itself in making a small and very irregular mesh between the ropes. It could run with facility on the surface of the water. When disturbed, it lifted up its fore-legs in the attitude of attention. On its first arrival it appeared very thirsty, and with exerted *mammillæ* drank eagerly of the fluid. Its stock of web seemed inexhaustible. While watching some that were suspended by a single thread, I several times observed that the slightest breath of the air bore them away out of sight in a horizontal line. On another occasion, under similar circumstances, I repeatedly observed the same kind of small spider, either when placed, or having crawled, on some little eminence, elevate its abdomen, send forth a thread, and then sail away in a lateral course, but with a rapidity which was quite unaccountable." A not less singular invasion has been experienced on the banks of the Indus. "I was taking a stroll," says the writer of a letter from Sukkur, dated September 17, "into the fields, when I found myself suddenly covered with a whole host of small and large spiders. On looking about, I observed that I was standing in the midst of a large cloud of these animals, who appeared descending in a filmy web of no small dimensions from the upper regions. Having extricated myself with some difficulty from their embraces, I took a position whence I could see about me, without being annoyed by them, and to my astonishment I beheld descending, maze within maze, and fold within fold, an innumerable host of spiders, all suspended and dancing on their numberless tiny threads, which were at times seen to glance in every variety of shade, amid the eams of the rising sun."—Ed.

pearing until its prey has fatigued itself by its struggles to obtain its liberty; for if the ravager should appear in all its terrors while the prey is but half involved, a desperate effort might give it force enough to get free. If the spider has fasted for a long time, it then drags the fly immediately into its hole, and devours it; but if there has been plenty of game, and the animal be no way pressed by hunger, it then gives the fly two or three turns in its web, so as completely to immesh it, and there leaves it impotently to struggle until the little tyrant comes to its appetite. Why the spider should at one time kill its prey, and at another suffer it to struggle in the toils for several hours together, I am not able to say; perhaps it only likes its prey newly killed, and therefore delays to put the captive to death until it is to be eaten.⁵

⁵ "Of all sorts of insects," says Evelyn, "there is none has afforded me more divertisement than the *venatores* (hunters), which are a sort of *lupi* (wolves) that have their dens in rugged walls and crevices of our houses; a small brown and delicately-spotted kind of spiders, whose hinder legs are longer than the rest. Such I did frequently observe at Rome, which, espying a fly at three or four yards distance upon the balcony where I stood, would not make directly to her, but crawl under the rail, till being arrived at the antipodes, it would steal up, seldom missing its aim; but if it chanced to want any thing of being perfectly opposite, would, at first peep, immediately slide down again,—till, taking better notice, it would come the next time exactly upon the fly's back; but if this happened not to be within a competent leap, then would this insect move so softly, as the very shadow of the gnomon seemed not to be more imperceptible, unless the fly moved; and then would the spider move also in the same proportion, keeping that just time with her motion as if the same soul had animated both these little bodies; and whether it were forwards, backwards, or to either side, without at all turning her body like a well managed horse: but if the capricious fly took wing and pitched upon another place behind our huntress, then would the spider whirl its body so nimbly about, as nothing could be imagined more swift: by which means she always kept the head towards her prey, though, to appearance, as immoveable as if it had been a nail driven into the wood, till by that indiscernible progress (being arrived within the sphere of her reach) she made a fatal leap, swift as lightning, upon the fly, catching him in the pole, where she never quitted hold till her belly was full, and then carried the remainder home." One feels a little sceptical, however, when he adds, "I have beheld them instructing their young ones how to hunt, which they would sometimes discipline for not well observing; but when any of the old ones did (as sometimes) miss a leap, they would run out of the field and hide themselves in their crannies, as ashamed, and haply not to be seen abroad for four or five hours after; for so long have I watched the nature of this strange insect, the contemplation of whose so wonderful sagacity and address has amazed me; nor do I find in any chase whatsoever more cunning and stratagem observed. I have found some of these spiders in my garden, when the weather, towards spring, is very hot, but they are nothing so eager in hunting as in Italy." We have only to add to this lively narrative, that the hunting spider, when he leaps, takes good care to provide against accidental falls by always

It has been the opinion of some philosophers, that the spider was in itself both male and female; but Lister has been able to distinguish the sexes, and to perceive that the males are much less in size than the females. But this is not the chief peculiarity; for, different from all other animals, except the fish called the ray, it has its instruments of generation placed in the fore arms, which have been already described. When these animals copulate, they for some time seize each other with their legs and arms, then appear the instruments of generation in the male, as if bursting out from the points of its fore-feet, and are inserted into the receptacle beneath the body of the female.

The female generally lays from nine hundred to a thousand eggs in a season; they are of a bluish colour, speckled with black, and separated from each other by a glutinous substance, not unlike frog-spawn water. These eggs are large or small in proportion to the size of the animal that produces them. In some they are as large as a grain of mustard-seed; in others they are scarcely visible. The female never begins to lay till she be two years old at the least, and her first brood is never so numerous as when she has come to her greatest maturity.

When the number of eggs which the spider has brought forth have remained for an hour or two to dry after exclusion, the little animal then prepares to make them a bag, where they are to be hatched until they leave the shell. For this purpose she spins a web four or five times stronger than that made for catching flies; and, besides, lines it within-side by a down, which she plucks from her own breast. This bag, when completed, is as thick as paper, is smooth within-side, but rougher without. Within this they deposit their eggs; and it is almost incredible to relate the concern and industry which they bestow in the preservation of it. They stick it by means of their glutinous fluid to the end of their body; so that the animal, when thus loaded, appears as if she had one body placed behind another. If this bag be separated from her by any accident, she employs all her assiduity to stick it again in its former situation, and seldom abandons her treasure but with her life. When the young ones are excluded from their shells, within the bag, they remain for some time in their confinement, until the female, instinctively knowing their maturity, bites open their prison, and sets them free. But her parental care does not terminate with their exclusion; she receives them upon her back for some time, until they have strength to provide for themselves, when they leave her never to return, and each begins a separate manufactory of its own. The young

swinging himself from a good strong cable of silk, as Swammerdam correctly states, and which any body may verify, as one of the small hunters, known by having its back striped with black and white like a zebra, is very common in Britain.—Ed.

ones begin to spin when they can scarcely be discerned; and prepare for a life of plunder before they have strength to overcome. Indeed, Nature seems to have formed them in every respect for a life of hostility. No other insect is possessed of such various powers of assault and defence; and they are able to destroy animals ten times bigger than themselves. Even after a severe defeat, they quickly recover of their wounds; and as for their legs, they consider the loss of them as but a small misfortune, as they grow again very speedily to their former magnitude.

Thus there is no insect to which they are not an enemy; but what is more barbarous still, spiders are the enemies of each other. Mr. Reaumur, who was fond of making experiments upon insects, tried to turn the labours of the spider to human advantage, and actually made a pair of gloves from their webs.

For this purpose, he collected a large number of those insects together: he took care to have them constantly supplied with flies, and the ends of young feathers, fresh picked from chickens and pigeons, which being full of blood, are a diet that spiders are particularly fond of. But, notwithstanding all his care, he was soon convinced that it was impracticable to rear them, since they were of such a malignant nature, that they could never be brought to live in society; but instead of their usual food, chose to devour each other. Indeed, were it practicable to reconcile them to each other, it would require too much attendance to rear up a sufficient number to make the project any way useful. Their thread is four, if not five times finer than that of the silk-worm; so that, upon the smallest calculation, there must have been sixty thousand spiders to make a single pound of silk. That which Reaumur made use of was only the web in which they deposited their eggs, which is five times stronger than their ordinary manufacture.

Of this animal, there are several kinds slightly differing from each other either in habits or conformation.⁶ The Water-spider is the most re-

⁶ The gossamer, bird-catching, and branded spiders are among the most remarkable. *Gossamer spiders* first appear in the beginning of October, in woods, gardens, and meadows, where their eggs are hatched in safety: thence they spread themselves over whole districts, and, during the rest of October, and till the middle of November, may be found in dry fields throughout Europe. Extensive tracts of land are sometimes seen swarming with them. In the beginning of October, when but very few are hatched, some single threads of their webs, extending from twig to twig, are seen only in the sunshine; about the middle of the month their threads are more perceptible; and toward the end, if a person stand in such a position as to see the sunbeams play upon their slender threads, hedges, meadows, cornfields, stubble land, and even whole districts, appear covered as with a sort of white gauze. The gossamer spider does not weave a web, but only extends its threads from one place to another. These are so delicate, that a single thread cannot be seen unless the sun

markable of the number. This insect resembles the common spider in its appearance, except that its hinder part is made rather in the shape of a nine-pin than a ball. They differ in being able

shines on it. One of them, to be visible at other times, must be composed of at least six common threads twisted together. In serene, calm days, these spiders work with great diligence, especially after the disappearance of the morning fogs. Between twelve and two, however, their industry excites the greatest admiration. A person with a pretty quick eye, or by the help of a glass, may sometimes perceive among the barley stubble such a multitude of these insects extending their threads, that the fields appear as if covered with swarms of gnats. Several of the single threads become twisted together by the gentlest breath in wind, and form perceptible threads, which, being broken by stronger winds, unite into thick threads, or even into balls, and float through the atmosphere. These are then called in Germany, the *flying summer*, because the summer seems to fly away at the same time. The spiders are conveyed in them: but it is not uncommon to find spiders of other species in them, which have been entangled and dragged away; and even the webs of other spiders, and the dried husks of insects that have been caught by them, are often found in the gossamer. The gossamer-spiders appear in swarms only during the harvest; but single spiders are to be found through the whole summer.

The *Bird-catching spider* is of gigantic size, and great muscular power, extending with its feet a space of near ten inches. From the head to the extremity of the abdomen it often measures above three inches. The legs are as thick as a goose's quill, and closely covered with hair. The body is brown, and the fangs are as strong and sharp as some of the rapacious species of birds. It is not uncommon in many parts of America, but is generally found in the southern division of that continent, and particularly in Guinea, and is a terror to all the feathered tribe. It resides in the trees, and frequently seizes on small birds, which it destroys by sucking their blood, after having first wounded them by its fangs, which distil a poisonous liquid into the wound. The slit or orifice near the tip of the fangs, through which this poison is emitted, is so visible as to be distinctly perceived without a glass. The eight eyes of this terrible insect are placed somewhat in the form of an oblong square in the front of the thorax; of these the two middle ones are so large as to be capable of being set in the manner of glasses, and used as microscopes; the rest are smaller, and of an oval shape. The thorax is orbicular, and has a transverse excavation. Captain Stedman, while residing in Surinam, had one of them given to him, which he put into a case bottle above eight inches long; and, when this was filled with spirits, the animal reached the surface with some of its claws, while others rested on the bottom. On the whole, he says, this spider is so hideous a creature that the very sight of it is sufficient to occasion a tremor of abhorrence, even in persons most accustomed to inspect the deformities of nature.

The *Banded spider* is a native of Barbary, and is as large as a man's thumb. It has yellow bands round the belly, and dusky rings round the legs. It inhabits hedges and thickets. Its webs have large meshes, and it resides in the centre; the snares are spread for large flies, wasps, drones, and even locusts: the lesser insects can escape through the meshes. The animal which it entangles is soon bound with strong threads, killed by the spider's jaws, and partly eat, if the spider be hungry; the rest is concealed under some neighbouring dry leaves, covered with a

to live as well by land as water; and in being capable of spinning as well in one element as the other. Their appearance under water is very remarkable; for though they inhabit the bottom, yet they are never touched by the element in which they reside, but are enclosed in a bubble of air that, like a box, surrounds them on every side. This bubble has the bright appearance, at the bottom, of quicksilver; and within this they perform their several functions of eating, spinning, and sleeping, without its ever bursting, or in the least disturbing their operations: sometimes the bubble is seen divided into three distinct apartments; and in the spring, the male enters one of these to impregnate the female in the manner mentioned above, while the bubble in which he was contained unites with the other, like two drops of water when approached to each other. They spin their webs as well in the water as upon land; and it is most probable that they make their food of the small insects of either element.⁷

The Tarantula is also of this species, and deserves particular notice, not for any remarkable properties that really attend it, but for the numerous falsehoods which have been propagated concerning it. What may be said with truth concerning it is, that it is the largest of the spider kind known in Europe, and is a native of Apulia in Italy. Its body is three quarters of an inch long, and about as thick as one's little finger; the colour is generally an olive brown, variegated with one that is more dusky; it has eight legs and eight eyes, like the rest, and nippers, which are sharp and serrated: between these and the fore legs, there are two little horns, or feelers, which it is observed to move very briskly when it approaches its prey. It is covered all over the body with a soft down, and propagates, as other spiders, by laying eggs. In the

kind of web, and blackish glue in great abundance: its larder is said to be often plentifully stored. Its nest is of the size of a pigeon's egg, divided horizontally, and suspended by the threads of the insect, which are of a silvery white, and stronger than silk. The young ones live in amity, but when grown up are mortal enemies; they never meet but they fight with violence, and their battle only ends with the death of the weakest: the dead body is carefully stored in the larder. Twelve of these spiders, by way of experiment, were shut up together, and after a battle of eight days the strongest only remained alive.—Ed.

⁷ That spiders may be able to breathe under water, we can well understand from their breathing like amphibious reptiles by means of gills; but there is an aquatic spider which is not contented, as a frog would be, with the air furnished by the water, but actually carries down a supply of air from the atmosphere to her subaqueous nest. This spider does not like stagnant water, but prefers slow-running streams and ditches, where she may often be seen, in the vicinity of London and elsewhere, living in her diving-bell, which shines through the water like a little globe of silver; her singular economy was first, we believe, described by Clerck, L. M. de Lignac, and De Geer.—Ed.

summer months, particularly in the dog days, the tarantula, creeping among the corn, bites the mowers and passengers; but in winter it lurks in holes, and is seldom seen.

Thus far is true; but now the fable begins: for though the bite is attended with no dangerous symptoms, and will easily cure of itself, wonderful stories are reported concerning its virulence. The part which is bitten, as we are told, is soon after discoloured with a livid, black, or yellowish circle, attended with an inflammation. At first the pain is scarcely felt; but a few hours after, come on a violent sickness, difficulty of breathing, fainting, and sometimes trembling. The person bit, after this does nothing but laugh, dance, skip about, putting himself into the most extravagant postures, and sometimes also is seized with a most frightful melancholy. At the return of the season in which he was bit, his madness begins again; and the patient always talks of the same things. Sometimes he fancies himself a shepherd, sometimes a king; appearing entirely out of his senses. These troublesome symptoms sometimes return for several years successively, and at last terminate in death. But so dreadful a disorder has, it seems, not been left without a remedy; which is no other than a well-played fiddle. For this purpose the medical musician plays a particular tune, famous for the cure, which he begins slow, and increases in quickness as he sees the patient affected. The patient no sooner hears the music, than he begins to dance; and continues so doing till he is all over in a sweat, which forces out the venom that appeared so dangerous. This dancing sometimes continues for three or four hours, before the patient is weary, and before the sweating is copious enough to cure the disorder. Such are the symptoms related of the tarantula poison; symptoms which some of the best and gravest physicians have credited, and attempted to account for. But the truth is, that the whole is an imposition of the peasants upon travellers who happen to pass through that part of the country, and who procure a trifle for suffering themselves to be bitten by the tarantula. Whenever they find a traveller willing to try the experiment, they readily offer themselves, and are sure to counterfeit the whole train of symptoms which music is supposed to remove. A friend of mine, who passed through that part of the country, had a trusty servant bitten, without ever administering the musical cure: the only symptoms were a slight inflammation, which was removed, and no other consequence ever attended the bite.—It is thus that falsehoods prevail for a century or two; and mankind at last begin to wonder how it was possible to keep up the delusion so long.⁸

⁸ In a very interesting paper on the Tarantula, *Lycosa Tarentula*, by M. Leon Dufour, published in the 'Annales des Sciences Naturelles,' and of which a translation is given in the number for February

CHAP. IV.

OF THE FLEA.

THE history of those animals with which we are the best acquainted, is the first object of our chiefest curiosity.—There are few but are well-informed of the agility and bloodthirsty disposi-

1837 of Loudon's Magazine, are the following particulars relative to its habits.—The tarantula inhabits dry, barren, uncultivated places exposed to the sun. It hides itself in burrows of a cylindrical form, often an inch in diameter, sunk more than a foot in the soil, for four or five inches vertical, then horizontal, and again perpendicular. The orifice is ordinarily surmounted by a funnel, sometimes two inches in diameter, rising about an inch above the surface of the soil, composed of fragments of dry wood, united by a little clay, and lined with a kind of tapestry, formed of the threads of the animal itself. This funnel not only protects its intrenchment from inundations, and fortifies it against the falling of external bodies, which, swept by the winds would be likely to close it up, but it also serves as an ambush, by offering to flies and other insects an enticing resting-place. The months of May and June are the most favourable season for seeking it. After various fruitless attempts to procure specimens, M. Dufour succeeded in the following manner:—It occurred to him to take, by way of bait, a stalk surmounted by a spikelet, and to shake it and rub it gently against the opening of the hole. He was not long in perceiving that the attention and desire of the tarantula was awakened. Tempted by this lure, he advanced, with a slow and irresolute step, towards the spikelet; and on its being drawn back a little, frequently used to throw himself at one spring, out of his dwelling, the entrance of which was instantly closed. It sometimes happened that, suspecting the snare, or, perhaps, less pressed by hunger, he held back, immovable, at a little distance from his door, which he did not judge it advisable to pass. When this occurred, M. Dufour, after having observed the direction of the hole, and the position of the spider, drove in the blade of his knife, so as to surprise the creature behind, and cut off his retreat. By employing this mode of capture, he sometimes took so many as fifteen in an hour. We shall conclude our extract with an account of a combat between two tarantulas. "In the month of June, one day when I had been successful in the search after the tarantulas, I chose two full-grown and very vigorous males, which I put together into a large vase, that I might witness the spectacle of a mortal combat. After having many times made the circuit of their arena, in the endeavour to shun each other, they hastened, as at a given signal, to set themselves in a warlike attitude. I saw them, with surprise, taking their distance, and gravely rising upon their hind legs, so as to present to each other the buckler formed by their chests. After looking each other in the face for about two minutes, and, without doubt, provoking each other by glances which I could not discern, I saw them throw themselves upon one another, entwine their legs, and endeavour, in an obstinate struggle, to wound each other with the hooks of their mandibles. Either from fatigue, or by mutual consent, the combat was for a while suspended: there was a truce for some seconds; and each wrestler, retiring to a little distance, resumed his menacing posture. This circumstance reminded me that, in the singular encounters of cats, there were also suspensions of arms. But the struggle was not long in

tion of the flea; of the caution with which it comes to the attack; and the readiness with which it avoids the pursuit. This insect, which is not only the enemy of mankind, but of the dog, cat, and several other animals, is found in every part of the world, but bites with greater severity in some countries than in others. Its numbers in Italy and France are much greater than in England; and yet its bite is much more troublesome here, than I have found it in any other place. It would seem that its force increased with the coldness of the climate; and though less prolific, that it becomes more predaceous.¹

If the flea be examined with a microscope, it will be observed to have a small head, large eyes, and a roundish body. It has two feelers, or horns, which are short, and composed of four joints; and between these lies its trunk, which it buries in the skin, and through which it sucks the blood in great quantities. The body appears to be all over curiously adorned with a suit of polished sable armour, neatly jointed, and beset with multitudes of sharp pins, almost like the quills of a porcupine. It has six legs, the joints of which are so adapted, that it can, as it were, fold them up one within another; and when it leaps, they all spring out at once, whereby its whole strength is exerted, and the body raised above two hundred times its own diameter.

The young fleas are at first a sort of nits or eggs, which are round and smooth; and from these proceed white worms, of a shining pearl colour: in a fortnight's time they come to a tolerable size, and are very lively and active; but if they are touched at this time, they roll themselves up in a ball: soon after this they begin to creep like silk-worms that have no legs: and they seek a place to lie hid in, where they spin a silken thread from their mouth, and with this they enclose themselves in a small round bag or case, as white within as writing-paper, but dirty

recommencing, with more fury than before, between our two tarantulas. One of them, after victory had been a long time doubtful, was at length overthrown, and mortally wounded in the head: he became the prey of the vanquisher, who tore open his skull, and devoured him."—ED.

¹ The strength of this animal is astonishing for its size. A flea will drag after it a chain a hundred times heavier than itself; and, to compensate for this force, will eat ten times its own weight of provisions in a day. Mr. Boverich, an ingenious watchmaker who some years ago lived in the Strand, London, exhibited to the public a little ivory chaise, with four wheels, and all its proper apparatus, and a man sitting on the box, all of which were drawn by a single flea. He made a small landau, which opened and shut by springs, with six horses harnessed to it; a coachman sitting on the box, and a dog between his legs; four persons in the carriage, two footmen behind it, and a postillion riding on one of the fore-horses, which was easily drawn along by a flea. He likewise had a chain of brass, about two inches long, containing two hundred links, with a hook at one end, and a padlock and key at the other, which the flea drew very nimbly along.—ED.

without; in this they continue for a fortnight longer; after which they burst from their confinement perfectly formed, and armed with powers to disturb the peace of an emperor.

SUPPLEMENTARY NOTE.

The *chigoe* is a kind of small sand-flea, so diminutive as to be almost imperceptible. Its legs have not the elasticity of those of fleas; for had the chigoes their power of leaping, there is not a living creature of the climates where they abound that would not be full of them; and this lurking race would destroy three-fourths of mankind by the evils they would produce. They are common in Surinam, and in many parts of America, and are always found among the dust, and principally in filthy places; they fix themselves on the legs, to the soles of the feet, and even to the fingers. The chigoe gets in between the skin and the flesh, and generally under the nails of the toes, in such a subtle manner, that, at the time, the person is not sensible of it; nor is it to be perceived till it begins to extend itself. At first it is not difficult to extract it; but, although it may only have introduced its head, it makes so firm a lodgment that a part of the skin must be sacrificed before it will quit its hold. If it be not soon perceived, the insect completes its lodgment, sucks the blood, and forms a nest of a white thin tunicle, in the shape of flat pearl. It extends itself in this space in such a manner, that its head and feet are towards the exterior side, for the convenience of nourishment; and the other part of the body answers to the inner side of the tunicle, in order to lay its eggs there. In proportion as these are laid, the little pearl is enlarged; and in four or five days it is at least four or five lines in diameter. It is then of the utmost consequence to have it extracted; for if this be neglected it bursts of itself, and spreads an infinity of nits, which, when hatched, fill the whole part, and produce excessive anguish; and the difficulty of dislodging them becomes very great. These penetrate to the very bones; and even when the sufferer has got rid of them, the pain will last till the flesh and skin are entirely healed. The operation of extracting them, at which the black girls are extremely dexterous, is long and painful. It consists in separating, with the point of a needle, the flesh next to the membrane where the eggs are lodged; which is not easily done without bursting the tunicle. After having separated even the most minute ligaments, the nest is to be extracted. If unfortunately it bursts, particular care must be taken to extract every root of it, and especially not to leave behind the principal insect. This would begin to lay its eggs again before the wound could be healed; and penetrating much farther into the flesh, would increase the difficulty of extracting. During the great heats extreme care must be taken not to wet the part affected. Without this precaution, experience has proved that the patient is subject to consequences that frequently prove fatal. Tobacco ashes are put into the orifice, by which, in a little time, the sore is perfectly healed. Some, by having neglected in time to root out these detestable vermin, have not only lost their limbs by amputation, but even their lives.

CHAP. V.

OF THE LOUSE, AND ITS VARIETIES.

THE antipathies of mankind are various; some considering the toad, some the serpent, some the

spider, and some the beetle, with a strong degree of detestation: but while all wonder at the strangeness of each other's aversions, they all seem to unite in their dislike to the louse, and regard it as their natural and most nauseous enemy. Indeed, it seems the enemy of man in the most odious degree; for wherever wretchedness, disease, or hunger seize upon him, the louse seldom fails to add itself to the tribe, and to increase in proportion to the number of his calamities.

In examining the human louse with the microscope, its external deformity first strikes us with disgust: the shape of the fore part of the head is somewhat oblong; that of the hind part somewhat round: the skin is hard, and being stretched, transparent, with here and there several bristly hairs: in the fore part is a proboscis or sucker, which is seldom visible: on each side of the head are antennæ, or horns, each divided into five joints, covered with bristly hair; and several white vessels are seen through these horns: behind these are the eyes, which seem to want those divisions observable in other insects, and appear encompassed with some few hairs: the neck is very short, and the breast is divided into three parts; on each side of which are placed six legs, consisting of six joints, covered also with bristly hairs; the ends of the legs are armed with two smaller and larger ruddy claws, serving these insects as a finger and thumb, by which they catch hold of such objects as they approach: the end of the body terminates in a cloven tail, while the sides are all over hairy; the whole resembling clear parchment, and, when roughly pressed, crackling with a noise.

When we take a closer view, its white veins, and other internal parts, appear, as likewise a most wonderful motion in its intestines, from the transparency of its external covering. When the louse feeds, the blood is seen to rush like a torrent into the stomach; and its greediness is so great that the excrements contained in the intestines are ejected at the same time, to make room for this new supply.

The louse has neither beak, teeth, nor any kind of mouth, as Dr. Hooke described it, for the entrance into the gullet is absolutely closed. In the place of all these, it has a proboscis or trunk; or, as it may be otherwise called, a pointed, hollow sucker, with which it pierces the skin, and sucks the human blood, taking that for food only. The stomach is lodged partly in the breast and back; but the greatest portion of it is in the abdomen. When swollen with blood, it appears of a dark brown colour, which is visible through the skin; and is either a faint red, or a full or bright brown, as the contents of the stomach are more or less changed. When it is empty, it is colourless; but when filled, it is plainly discernible, and its motion seems very extraordinary. It then appears working with very strong agitations, and somewhat resembles

an animal within an animal. Superficial observers are apt to take this for the pulsation of the heart; but if the animal be observed when it is sucking, it will then be found that the food takes a direct passage from the trunk to the stomach, where the remainder of the old aliment will be seen mixing with the new, and agitated up and down on every side.

If this animal be kept from food two or three days, and then placed on the back of the hand, or any soft part of the body, it will immediately seek for food; which it will the more readily find, if the hand be rubbed till it grows red.—The animal then turns its head, which lies between the two fore-legs, to the skin, and diligently searches for some pore: when found, it fixes the trunk therein; and soon the microscope discovers the blood ascending through the head, in a very rapid, and even frightful stream. The louse has at that time sufficient appetite to feed in any posture; it is then seen sucking with its head downward, and its tail elevated. If, during this operation, the skin be drawn tight, the trunk is bound fast, and the animal is incapable of disengaging itself; but it more frequently suffers from its gluttony, since it gorges to such a degree, that it is crushed to pieces by the slightest impression.

Whether lice are distinguished by the parts of generation into males and females is not yet discovered: Swammerdam is inclined to think that they are hermaphrodites, having found an ovary in all those he examined; and he dissected not less than forty-two. In one of these animals were found ten large eggs; and forty-four smaller, that were not yet come to their full perfection.

There is scarce any animal that multiplies so fast as this unwelcome intruder. It has been pleasantly said that a louse becomes a grandfather in the space of twenty-four hours: this fact cannot be ascertained; but nothing is more true than that the moment the nit, which is no other than the egg of the louse, gets rid of its superfluous moisture, and throws off its shell, it then begins to breed in its turn. Nothing so much prevents the increase of this nauseous animal as cold and want of humidity; the nits must be laid in a place that is warm, and moderately moist to produce anything. This is the reason that many nits laid on the hairs in the night-time, are destroyed by the cold of the succeeding day; and so stick for several months, till they at last come to lose even their external form.

The louse is found upon every part of the human body; but particularly in the heads of children. Those found upon the miners in Sweden, are said by Linnæus to be very large; and he is of opinion that the head and the body louse differ in no respect from each other. The pthiriasis, or lousy disease, though very little known at present, was frequent enough among the ancients: Herod, Antiochus Epiphanes, Aleman

the poet, Pherecydes, Cassander, Callisthenes, and Sylla, all died of this disorder. The use of mercury, which was unknown among the ancients, may probably have banished it from among the moderns; for certain it is, that these animals seldom attack any in our climate, but such as from sloth or famine invite their company.

Such is the history of the human louse, which, from its connection with mankind deserves first notice: but it would be endless to describe the various tribes that go under this name, and swarm upon every part of nature. There is scarce an animal, and scarce even a vegetable, that does not suffer under its own peculiar louse. The sheep, the horse, the hog, and the elephant, are all teased by them; the whale, the shark, the salmon, and the lobster, are not without their company; while every hothouse and every garden is infested with some peculiarly destructive. Linnæus tells us, that he once found a vegetable-louse upon some plants newly arrived from America; and, willing to trace the little animal through its various stages, he brought it with him from London to Leyden, where he carefully preserved it during the winter, until it bred in the spring; but the louse it seems did not treat him with all the gratitude he expected; for it became the parent of so numerous a progeny, that it soon overrun all the physic-garden of that beautiful city; and leaves to this day many a gardener to curse the Swede's too indulgent curiosity.

The animal which some have called the leaf-louse, is of the size of a flea, and of a bright green or bluish-green colour; the body is nearly oval, and is largest and most convex on the hinder part; the breast is very small, and the head is blunt and green: the eyes may be seen very plainly, being prominent on the fore part of the head, and of a shining black colour; near these there is a black line on each side; and the legs are very slender.¹

¹ The minute animals which compose the singular tribe of *Aphides* live entirely on vegetables, and the loftiest trees are as liable to their attacks as the most humble plant. Their numbers are often incalculably great. They prefer the young shoots on account of their tenderness, and frequently insinuate themselves into the very hearts of the plants, doing irreparable mischief even before they are discovered. But for the most part they beset the foliage, and are always found on the under side of the leaf. This they prefer, not only on account of its being most tender, but because it affords them protection from the weather. Some of the species are constantly and unalterably attached to one or more particular kind of plants; but others feed indiscriminately on most sorts of herbage. These insects are sometimes winged, and sometimes destitute of wings, without any distinction of sex. In the spring they are viviparous, producing their offspring alive; and in the autumn they are oviparous, depositing their eggs, like most other insects, in places where they remain secure through the winter till the ensuing spring, when they are hatched. The aphides afford also

These animals are usually found on the leaves of the orache and other plants; and the weaker the leaves and buds are, these insects swarm upon them in greater abundance. Some plants are covered over by them; though they are not the cause of the plant's weakness, but the sign: however, by wounding and sucking the leaf, they increase the disease. They generally assume their colour from the plant on which they reside. Those that feed upon pot-herbs and plumb-trees, are of an ash-colour; only they are greenish when they are young; those that belong to the alder and cherry-tree, are black; as also those upon beans, and some other plants: those on the leaves of apples and rose-trees are white; but as they leap like grasshoppers, some place them in the number of the flea kind. The most uncommon colour is reddish; and lice of this sort may be seen on the leaves of tansey; and their juice, when rubbed on the hands, tinges them with no disagreeable red. All these live upon their respective plants; and are often engendered within the very substance of the leaf.

All these bring forth their young alive; and the foetus, when it is ready to be brought forth, entirely fills the belly of the female; its foreparts being excluded first, and then the hinder. The young one does not begin to move till the horns or feelers appear out of the body of the old one; and by the motion of these it first shows signs of life, moving them in every direction, and bending all their joints. When the horns and head are excluded, the two fore-feet follow, which they move with equal agility; after this follow the middle feet, and then the hinder: still, however, the young one continues sticking to its parent, supported only at one extremity, and hanging, as it were, in air, until its small and soft members become hardened and fitted for self-support. —The parent then gets rid of its burden; by

another surprising deviation from the general laws of nature; one impregnation of a female is sufficient for nine generations. The larvæ, chrysalides, and perfect insects, have so little difference in external appearance, that they cannot be distinguished from each other.

If the aphides had not many enemies, their increase in summer would be so great, as by wounding and exhausting the tender shoots of the trees, sometimes to suppress their vegetation. Among their enemies, one of the principal is a small black species of ichneumon-fly, which darts its pointed tail into the bodies of the aphides, and at the same time deposits an egg in each. This egg afterwards produces a grub, which feeds on the body of the insect till it has acquired its full growth, when it undergoes its change, and entirely destroys its living nidus. After a mild spring, most of the species of aphides become so numerous as to do considerable injury to the trees on which they are found. The best mode to remedy this evil is to lop off the infected shoots before the insects greatly multiplied, repeating the same operation before the time that the eggs are deposited. By the first pruning, a very numerous present increase will be prevented; and by the second, the following year's supply may in a great measure be cut off. — Ep.

moving from the place where she was sitting, and forcing the young one to stand upon its legs, leaves it to shift for itself.

As the animal has not far to go, its provisions lying beneath it, during the summer it continues to eat and creep about with great agility. But as it is viviparous, and must necessarily lurk somewhere in winter, where its body may be defended from the cold, it endeavours to secure a retreat near the trees or plants that serve to nourish it in the beginning of spring. They never hide themselves in the earth, like many other insects, because they have no part of their bodies fitted to remove the earth; nor can they creep into every chink, as their legs are too long; besides, their bodies are so tender, that the least rough particle of the earth would hurt them. They, therefore, get into the deep chinks of the bark, and into the cavities of the stronger stalks, from whence they sally out upon the branches and leaves, when the warmth of the sun begins to be felt. Neither the cold in the autumnal season, nor the lesser degree of heat in the spring, ever hurts them; they seldom, therefore, seek for hiding-places before the fall of the leaf, and are alert enough to take the earliest advantage of the returning spring.

Like many other insects, they cast their skins four several times; and, what is very remarkable, the males have four wings, but the females never have any. They all have long legs, not only to enable them to creep over the long hairs of plants and leaves, but also to travel from one tree to another when they happen to stand at a distance. Their trunk or snout lies under their breast; and this they thrust into the pores of the plant to suck out the juice, for they do not gnaw them, like the caterpillar; but so hurt them by sucking, that the leaves become spotted, and as it were overrun with scabs; for which reason their edges always turn up towards the middle.

It has been said, that these insects are often carried away and devoured by ants; but this Frysche, from whom this description is taken, could never observe. The ants, indeed, are fond of those trees where there is a great number of these insects; but then it is only to suck the juice which flows from the leaves that have been just wounded. This more particularly happens in the heat of summer, when other moisture is wanting; however, he never found them hurting or carrying away any of these insects while alive; nor, indeed, were they able, for the leaf-louse is more than a match for the ant at single combat. Whenever they perceive the ant approaching behind them, they kick back with their hinder-feet, and thus drive off the invader, as a horse would a lion.

The three principal and constant enemies to these insects are, first, the fire-fly, which lays its eggs where these insects are in greatest number, which, producing a worm, seizes and devours all

the leaf-lice that come near it: another enemy is the worm of a peculiar kind of beetle, which destroys them, in great numbers: but the most formidable of all enemies is the ichneumon fly, that seizes upon one of the largest females, and laying its egg upon her, this is hatched into a worm, which soon devours and destroys the animal from whose body it sprung.

CHAP. VI.

OF THE BUG AND ITS VARIETIES.

THE Bug is another of those nauseous insects that intrude upon the retreats of mankind; and that often banish that sleep, which even sorrow and anxiety permitted to approach. This, to many men, is of all other insects the most troublesome and obnoxious. The night is usually the season when the wretched have rest from their labour; but this seems the only season when the bug issues from its retreats, to make its depredations. By day it lurks, like a robber, in the most secret parts of the bed; takes the advantage of every chink and cranny, to make a secure lodgment; and contrives its habitation with so much art, that scarce any industry can discover its retreat. It seems to avoid the light with great cunning; and if candles be kept burning, this formidable creature will not issue from its hiding-place. But when darkness promises security, it then issues from every corner of the bed, drops from the tester, crawls from behind the arras, and travels with great assiduity to the unhappy patient, who vainly wishes for rest and refreshment. It is generally vain to destroy one only, as there are hundreds more to revenge their companion's fate; so that the person who thus is subject to be bitten, remains the whole night like a sentinel upon duty, rather watching the approach of fresh invaders, than inviting the pleasing approaches of sleep.

Nor are these insects less disagreeable from their nauseous stench, than their unceasing appetites. When they begin to crawl, the whole bed is infected with the smell: but if they are accidentally killed, then it is insupportable.

These are a part of the inconveniences that result from the persecution of these odious insects; but happily for Great Britain, they multiply less in these islands than in any part of the continent. In France and Italy the beds, particularly in their inns, swarm with them; and every piece of furniture seems to afford them a retreat. They grow larger also with them than with us, and bite with more cruel appetite.

This animal, if examined minutely, appears to consist of three principal parts; the head, the corselet, and the belly. It has two brown eyes, that are very small, and a little prominent, besides two feelers, with three joints; underneath

these there is a crooked trunk, which is its instrument of torture, and which, when in motion, lies close upon the breast. The breast is a kind of ring, in which are placed the two first pair of legs. The belly consists of nine rings; under which are placed two pair of legs more, making six in all. Each leg has three joints, which form the thigh, the leg, and the foot, which is armed with a crooked claw, like a hook. The body is smooth, except a few short hairs, that may be seen by the microscope, about the vent, and on the two last rings. Its motion is slow and unwieldy; yet its sight is so exquisite, that the instant it perceives the light, it generally makes good its retreat; and they are seldom caught, though the bed swarms with them.

If we examine this insect internally, we shall find the great artery, which in all insects performs the functions of the heart; we shall find the apertures of the lungs on the right side and the left, through which the animal breathes; we shall find a stomach and intestines, which, as in other animals, run from the mouth to the anus. If the insect has been long kept fasting, there will be a mucus found in its body, like the white of an egg; but if crushed after a full meal, the human blood which it has sucked in will appear a little darkened, by having passed through the insect's body.

The male and female of these animals are plainly distinguishable from each other; and the parts of generation are obvious enough. They are often found coupling tail to tail; and in this state are very easily destroyed. The female has an ovary filled with eggs, joined together like a bunch of grapes; each egg being an oblong, almost cylindrical, inclining to white, and pretty transparent. In about two days after impregnation by the male, she deposits her eggs to the number of about a hundred and fifty, in some convenient place where they are likely to receive no disturbance. There they continue for some months; during which time, neither cold nor heat, neither moisture nor fumigation, can in the least retard their exclusion; but they come forth active, and ready for mischief.¹ It is this hardness in the shell that seems to continue the breed; as the old ones die every winter, or are easily destroyed by any fumigation that is

¹ The female generally lays about fifty eggs at a time, which are white, and when protruded are covered with a viscous matter, which afterwards hardening sticks them firmly to the place where they are deposited. These are usually hatched in about three weeks. The general times of laying are March, May, July, and September; so that from every female bug that outlives the season, as many as two hundred young ones may be produced. Thus is the extensive increase of these nauseous animals to be accounted for, where proper care is not taken to destroy them. The young, for some time after they first escape from the egg, are perfectly white, but they generally become brown in the course of about three weeks. In eleven weeks they are at full growth.—ED.

used for that purpose. But the eggs seem incapable of destruction; even those men who make a livelihood by killing these nauseous insects, though they can answer for the parent, can never be sure of the egg. For this reason they usually pay those houses to which they are called a second or a third visit, and at last exterminate them by perseverance.

The manner of destroying them seems rather the effects of assiduity than antidote; for the men called in upon this occasion, take every part of the furniture asunder, brush every part of it with great assiduity, anoint it with a liquid which I take to be a solution of corrosive sublimate, and having performed this operation twice or thrice, the vermin are most usually destroyed.

Cleanliness, therefore, seems to be the best antidote to remove these nauseous insects; and wherever that is wanting, their increase seems but a just punishment. Indeed, they are sometimes found in such numbers among old furniture, and neglected chambers, exposed to the south, that, wanting other sustenance, they devour each other. They are also enemies to other vermin, and destroy fleas very effectually; so that we seldom have the double persecution of different vermin in the same bed. Of the bug kind Linnæus reckons up forty.

SUPPLEMENTARY NOTE.

The *Bed bug* is supposed to have been introduced into this country in the fir timber that was brought over for the purpose of rebuilding London, after it had suffered by the great fire: for it is generally said that bugs were not known in England before that time; and many of them were found almost immediately afterwards in the new-built houses. Their most favourite food is blood, dried paste, size, deal, beech, osier, and some other kinds of timber, the sap of which they suck; and on any of these they are able to exist. They will not feed on oak, walnut, cedar, or mahogany; for several pairs which, for the sake of experiment, were confined with these kinds of wood, soon died, while those kept with the other continued to thrive through the whole year.

The *Leek-green bug* is to be found in Great Britain, as well as in many other parts of Europe. Its body is green, without spots; the abdomen black above, the margin spotted with yellow; the body beneath of a yellowish green; with six yellow legs. The antennæ sometimes entirely reddish brown; their last joints are tipped with black.

CHAP. VII.

OF THE WOOD-LOUSE AND ITS VARIETIES.

THE common wood-louse is seldom above half an inch long, and a quarter of an inch broad. The colour is of a livid black, especially when found about dunghills, and on the ground; but those that are to be met with under tiles, and in drier places, are the colour of the hair of an ass.—It has fourteen feet, seven on each side; and they

have only one joint each, which is scarcely perceivable. It has two short feelers, and the body is of an oval shape. When it is touched it rolls itself up into a sort of ball; and the sides near the feet are dentated like a saw. It is often found among rotten timber, and on decayed trees: in winter it lies hid in the crevices of walls and all sorts of building. The male is easily distinguishable from the female, being less and more slender. The eggs they lay are white and shining, like seed-pearls, and are very numerous: however, more properly speaking, although, when excluded, the young have all the appearance of an egg, yet they are alive, and, without throwing off any shell, stir and move about with great vivacity; so that this animal may properly be said to be viviparous. The little worms at first seem scarcely able to stir; but they soon feed, and become very brisk. These animals are of great use in medicine, being impregnated with a saline quality, which is diuretic and stimulating. Of this insect, Linnæus makes three species.

CHAP. VIII.

OF THE MONOCULUS, OR ARBORESCENT WATER-FLEA.

THIS animal, which is of the size of a flea, appears to the sight, unassisted by the microscope, to have but one eye; for the eyes, by reason of the smallness of the head, seem to be joined to each other: they are situated in the trunk of this insect, and the beak is likewise very small and sharp-pointed. The structure of the eye is seen, by the microscope, to be reticulated, or made like a net; and the trunk of this insect, by which it feeds, is not only small and sharp, but also transparent. The insects are of a blood red colour; and sometimes are seen in such multitudes on the surface of standing waters, as to make them appear all over red, whence many fanciful people have thought the water to be turned into blood.

Swammerdam tells us of a celebrated professor at Leyden, who was at first astonished by an appearance of this kind.—Being once intent upon his studies, he heard a noise, of which as it increased by degrees, he was desirous to know the cause. The maid-servant attending to his summons, appeared quite petrified with fear, and told him, with a tremulous voice, that all the waters of Leyden were turned into blood! Upon this he went directly, in a small bark, to the place where the water was thus changed, and put some of the bloody water into a glass: but upon viewing it with attention, he observed, that it abounded with infinite numbers of these little red insects, which tinged the whole body of the fluid with that seemingly formidable col-

our. Thus his sudden fright was changed into lasting admiration.

Of all parts of this animal, its branching arms, and the motion it makes with them in the water, deserve our greatest attention. By these the little creature can move in a straight line; waving its arms, as a bird does its wings in the air, sometimes upward, sometimes downward, sometimes to the right, sometimes to the left, yet still continuing to proceed in a right line. By striking the water with its arms it can ascend with great velocity: and by striking it in a contrary direction, it dives with equal ease. As these motions are very rapid, the little animal appears to jump in the water, its head always tending to the surface, and its tail stretched downward. This insect is produced from an egg, which, when excluded, is carried on the back of the female, and soon is seen floating in the water round her. Its appearance at first is that of a very small whitish insect, endued with a very nimble motion. Except in colour, it suffers no change, only continuing to grow larger and redder as it grows old. They sometimes remain several days on the surface of the water; and sometimes are seen at the bottom only; but they are never at rest. They change their skin like most other insects; and the cast skin resembles the insect itself so exactly, that one might mistake the mask for the animal.

SUPPLEMENTARY NOTE.

The *Canceroid Monoculus* has a convex shell rounded in front, and truncated behind; the tail is furnished with two bristle-shaped processes. This insect is by far the largest of the European monoculi; exhibiting with great distinctness, the numerous branchial and other parts, which in the smaller species are only to be viewed by the assistance of a microscope. The Linnæan genus *monoculus* has, by Fabricius Muller, been subdivided into different distinct genera, on account of the disposition of the eyes, which in some species are approximated, so as to appear as if single, while in others they are remote from each other.

The *Four-horned Monoculus* may be considered as one of the most common of the genus to which it belongs, occurring during the whole year in the clearer ponds of stagnant waters, wells, &c. In the size of the body it scarcely exceeds a large mite, but if measured from the extremities of its limbs, will sometimes be found to equal the eighth of an inch in length. The female is, in general, distinguished by the remarkable appearance of the ovaries, which bear a resemblance to a double cluster of grapes in miniature.

CHAP. IX.

OF THE SCORPION AND ITS VARIETIES.

THERE is scarcely an insect without wings that is not obnoxious to man: the smallest have the power of annoying him, either by biting or stinging him; and though each is in itself contempti-

ble, they become formidable from their numbers. But of all this class, there is none so terrible as the scorpion, whose shape is hideous, whose size among the insect tribe is enormous, and whose sting is generally fatal. Happy for England, the scorpion is entirely a stranger among us! In several parts of the continent of Europe it is but too well known, though it seldom grows above four inches long: but in the warm tropical climates it is seen a foot in length, and in every respect as large as a lobster.

The scorpion is one of the largest of the insect tribe, and not less terrible from its size than its malignity. It resembles a lobster somewhat in shape, but is infinitely more hideous. There have been enumerated nine different kinds of this dangerous insect, chiefly distinguished by their colour, there being scorpions yellow, brown, and ash-coloured; others that are the colour of rusty iron, green, pale yellow, black, claret-colour, white, and gray.

There are four principal parts distinguishable in this animal; the head, the breast, the belly, and the tail. The scorpion's head seems, as it were, jointed to the breast; in the middle of which are seen two eyes; and a little more forward, two eyes more, placed in the fore-part of the head: these eyes are so small, that they are scarcely perceivable; and it is probable the animal has but little occasion for seeing. The mouth is furnished with two jaws; the undermost is divided into two, and the parts notched into each other, which serves the animal as teeth, and with which it breaks its food, and thrusts it into its mouth: these the scorpion can at pleasure pull back into its mouth, so that no part of them can be seen. On each side of the head are two arms, each composed of four joints; the last of which is large, with strong muscles, and made in the manner of a lobster's claw. Below the breast are eight articulated legs, each divided into six joints; the two hindmost of which are each provided with two crooked claws, and here and there covered with hair. The belly is divided into seven little rings; from the lowest of which is continued a tail composed of six joints, which are bristly and formed like little globes, the last being armed with a crooked sting. This is that fatal instrument which renders this insect so formidable: it is long, pointed, hard, and hollow; it is pierced near the base by two small holes, through which, when the animal stings, it ejects a drop of poison, which is white, caustic, and fatal. The reservoir in which this poison is kept, is in a small bladder near the tail, into which the venom is distilled by a peculiar apparatus. If this bladder be gently pressed, the venom will be seen issuing out through the two holes above-mentioned: so that it appears, that when the animal stings, the bladder is pressed and the venom issues through the two apertures into the wound.

There are few animals more formidable, or

more truly mischievous than the scorpion. As it takes refuge in a small place, and is generally found sheltering in houses, so it cannot be otherwise than that it must frequently sting those among whom it resides. In some of the towns of Italy, and in France, in the province of Languedoc, it is one of the greatest pests that torment mankind: but its malignity in Europe is trifling, when compared to what the natives of Africa and the east are known to experience. In Batavia, where they grow twelve inches long, there is no removing any piece of furniture, without the utmost danger of being stung by them. Bosman assures us, that, along the Gold Coast, they are often found larger than a lobster; and that their sting is inevitably fatal. In Europe, however, they are by no means so large, so venomous, or so plentiful. The general size of this animal does not exceed two or three inches; and its sting is very seldom found to be fatal. Maupertuis, who made several experiments on the scorpion of Languedoc, found it by no means so invariably dangerous as had till then been represented. He provoked one of them to sting a dog, in three places of the belly, where the animal was without hair: in about an hour after the poor animal seemed greatly swollen, and became very sick; he then cast up whatever he had in his bowels; and for about three hours continued vomiting a whitish liquid. The belly was always greatly swollen, when the animal began to vomit; but this operation always seemed to abate the swelling; which alternately swelled, and was thus emptied, for three hours successively. The poor animal, after this, fell into convulsions, bit the ground, dragged himself along upon his fore-feet, and at last died, five hours after being bitten. He was not partially swollen round the place which was bitten, as is usual after the sting of a wasp or a bee; but his whole body was inflated, and there only appeared a red spot on the places where he had been stung.

Some days after, however, the same experiment was tried upon another dog, and even with more aggravated cruelty; yet the dog seemed no way affected by the wounds, but howling a little when he received them, continued alert and well after them; and soon after was set at liberty, without showing the smallest symptoms of pain. So far was this poor creature from being terrified at the experiment, that he left his own master's house, to come to that of the philosopher, where he had received more plentiful entertainment. The same experiment was tried by fresh scorpions, upon seven other dogs, and upon three hens; but not the smallest deadly symptom was seen to ensue. From hence it appears that many circumstances, which are utterly unknown, must contribute to give efficacy to the scorpion's venom. Whether its food, long fasting, the season, the nature of the vessels it wounds, or its state of maturity, contribute to, or retard its malignity, is yet to be ascertained

by succeeding experiment. In the trials made by our philosopher, he employed scorpions of both sexes, newly caught, and seemingly vigorous and active. The success of this experiment may serve to show, that many of those boasted antidotes which are given for the cure of the scorpion's sting, owe their success rather to accident than their own efficacy. They only happened to cure, when their sting was no way dangerous; but in cases of actual malignity, they might probably be utterly unserviceable.

The scorpion of the tropical climates being much larger than the former, is probably much more venomous. Helbigius, however, who resided for many years in the East, assures us, that he was often stung by the scorpion, and never received any material injury from the wound: a painful tumour generally ensued; but he always cured it by rubbing the part with a piece of iron or stone, as he had seen the Indians practise before him, until the flesh became insensible. Seba, Moore, and Bosman, however, give a very different account of the scorpion's malignity; and assert, that unless speedily relieved, the wound becomes fatal.¹

It is certain that no animal in the creation seems endued with such an irascible nature. I have often seen them taken and put into a place of security, exerting all their rage against the sides of the glass vessel that contained them. I have seen them attempt to sting a stick, when put near them; and attack a mouse or a frog, while those animals were far from offering any injury. Maupertuis put three scorpions and a mouse into the same vessel together, and they soon stung the little animal in different places. The mouse, thus assaulted, stood for some time upon the defensive, and at last killed them all, one after another. He tried this experiment, in order to see whether the mouse, after it had killed, would eat the scorpions; but the little quadruped seemed entirely satisfied with the victory, and even survived the severity of the wounds it had received. Wolkamer tried the courage of the scorpion against the large spider, and enclosed several of both kinds in glass vessels for that purpose.² The success of this combat was very remarkable. The spider at first used all its efforts to immesh the scorpion in its web, which it immediately began spinning; but the scorpion rescued itself from the danger, by stinging its adversary to death: it soon after cut off, with its claws, all the legs of the spider, and then sucked all the internal parts at its leisure. If the scorpion's skin had not been so hard, Wolkamer

is of opinion that the spider would have obtained the victory; for he had often seen one of these spiders destroy a toad.

The fierce spirit of this animal is equally dangerous to its own species; for scorpions are the cruellest enemies to each other. Maupertuis put about a hundred of them together in the same glass; and they scarcely came into contact, when they began to exert all their rage in mutual destruction: there was nothing to be seen but one universal carnage, without any distinction of age or sex; so that in a few days there remained only fourteen, which had killed and devoured all the rest.

But their unnatural malignity is still more apparent in their cruelty to their offspring. He enclosed a female scorpion, big with young, in a glass vessel, and she was seen to devour them as fast as they were excluded: there was but one only of the number that escaped the general destruction, by taking refuge on the back of its parent; and this soon after revenged the cause of its brethren, by killing the old one in its turn.

Such is the terrible and unrelenting nature of this insect, which neither the bonds of society nor of nature can reclaim: it is even asserted that, when driven to an extremity, the scorpion will often destroy itself. The following experiment was ineffectually tried by Maupertuis; but I am so well assured of it by many eye-witnesses, who have seen it both in Italy and America that I have no doubt remaining of its veracity. A scorpion, newly caught, is placed in the midst of a circle of burning charcoal, and thus an egress prevented on every side: the scorpion, as I am assured, runs for about a minute round the circle, in hopes of escaping: but finding that impossible, it stings itself on the back of the head, and in this manner the undaunted suicide instantly expires.

It is happy for mankind that these animals are thus destructive to each other; since otherwise they would multiply in so great a degree as to render some countries uninhabitable. The male and female of this insect are very easily distinguishable; the male being smaller and less hairy. The female brings forth her young alive, and perfect in their kind.³ Rhedi having bought a quantity of scorpions, selected the females, which by their size and roughness were easily distinguishable from the rest, and putting them in separate glass vessels, he kept them for some days without food. In about five days one of them brought forth thirty-eight young ones, well shaped, and of a milk-white colour, which changed every day more and more into a dark rusty hue. Another female, in a different vessel, brought forth twenty-seven of the same colour:

¹ Many experiments have been made to ascertain the strength of the poison; and in warm climates it has uniformly been found fatal to the smaller animals. To man the wound is extremely painful. The place becomes inflamed, and the surrounding parts often turn livid, and require to be carefully dressed in order to prevent mortification.—Ed.

² Ephemerides, Dec. 2, 1687, Observ. 224.

³ All the scorpion tribe are produced from eggs, of which one female lays a considerable number. After their escape from the egg, they undergo no farther transformation, except occasionally casting their skin like the spider.—Ed.

and the day following the young ones seemed all fixed to the back and belly of the female. For near a fortnight all these continued alive and well: but afterwards some of them died daily; until, in about a month, they all died except two.

Were it worth the trouble, these animals might be kept living as long as curiosity should think proper. Their chief food is worms and insects; and upon a proper supply of these, their lives might be lengthened to their natural extent. How long that may be, we are not told; but if we may argue from analogy, it cannot be less than seven or eight years; and perhaps, in the larger kind, double that duration. As they have somewhat the form of the lobster, so they resemble that animal in casting their shell, or more properly their skin; since it is softer by far than the covering of the lobster, and set with hairs, which grow from it in great abundance, particularly at the joinings. The young lie in the womb of the parent, each covered up in its own membrane, to the number of forty or fifty, and united to each other by an oblong thread, so as to exhibit altogether the form of a chaplet.

Such is the manner in which the common scorpion produces its young; but there is a scorpion of America, produced from the egg, in the manner of the spider. The eggs are no larger than pin-points; and they are deposited in a web, which they spin from their bodies, and carry about with them till they are hatched. As soon as the young ones are excluded from the shell, they get upon the back of the parent, who turns her tail over them, and defends them with her sting. It seems probable, therefore, that captivity produces that unnatural disposition in the scorpion, which induces it to destroy its young; since, at liberty, it is found to protect them with such unceasing assiduity.

SUPPLEMENTARY NOTE.

The *Black scorpion* of Ceylon is a very dangerous insect, and its sting is frequently mortal. This species is about four inches long, and from one to two broad over the middle of the body. When running, or disturbed, their tail is usually carried on their backs. They bite with their fangs, or forceps, and instantly dart the sting, which lies in their tail, into the place they have bitten. Their sting emits a poison resembling milk, but not altogether so white. When these scorpions are attacked by their inveterate enemy the ant, and cannot get rid of him, they sting themselves to death.

The *African scorpion* is in colour a deep brown, nearly approaching in some specimens to black. It grows to a very large size, sometimes nearly a foot long.

CHAP. X.

OF THE SCOLOPENDRA AND GALLY-WORM.

Of these hideous and angry insects we know little, except the figure and the noxious qualities. Though with us there are insects somewhat resembling them in form, we are placed at a happy distance from such as are really formidable. With us they seldom grow above an inch long; in the tropical climates they are often found above a quarter of a yard.

The Scolopendra is otherwise called the Centipes, from the number of its feet; and it is very common in many parts of the world, especially between the tropics. Those of the East Indies, where they grow to the largest size, are about six inches long, of a ruddy colour, and as thick as a man's finger: they consist of many joints; and from each joint is a leg on each side; they are covered with hair, and seem to have no eyes; but there are two feelers on the head, which they make use of to find out the way they are to pass; the head is very round, with two small sharp teeth, with which they inflict wounds that are very painful and dangerous. A sailor that was bit by one on board a ship, felt an excessive pain, and his life was supposed to be in danger: however, he recovered by the application of three roasted onions to the part, and was soon quite well. Of this animal there are different kinds: some living, like worms, in holes in the earth; others under stones, and among rotten wood: so that nothing is more dangerous than removing those substances, in the places where they breed.

The Gally-worm differs from the scolopendra, in having double the number of feet; there being two on each side, to every joint of the body. Some of them are smooth, and others hairy; some are yellow, some black, and some brown. They are found among decayed trees, between the wood and the bark; as also among stones that are covered with moss. They all, when touched, contract themselves, rolling themselves up like a ball. Whatever may be their qualities in the tropical parts of the world, in Europe they are perfectly harmless; having been often handled and irritated, without any vindictive consequences.

All these, as well as the scorpion, are supposed to be produced perfect from the parent, or the egg; and to undergo no changes after their first exclusion. They are seen of all sizes; and this is a sufficient inducement to suppose, that they preserve their first appearance through the whole of their existence. It is probable, however, that, like most of this class, they often change their skins; but of this we have no certain information.

SUPPLEMENTARY NOTE.

None of the insect tribe, the scorpions excepted, are so formidable in appearance as the centipede or *Great scolopendra*. It is found in the East and West Indies, and in various parts of Africa, inhabiting chiefly the woods, where it is preyed upon by the different species of snakes. It is, however, sometimes found in houses, and is said to be so common in particular districts, that the inhabitants are obliged to have the feet of their beds placed in vessels of water, in order to prevent their being annoyed during night by these horrible reptiles.

The scolopendræ vary greatly both in size and colour. Some of them are of a deep reddish brown; others of a yellow ochre colour, livid yellow, or tinged with red; and are sometimes seen about a foot in length: they are, however, generally much less. Their legs terminate in very sharp hooks, or nails, of a shining black colour; and all the other legs are furnished with smaller ones of the same kind.

Gronovius says, that all the legs of this detestable animal are venomous; but its most formidable weapons are the two sharp and hooked instruments that are placed under its mouth, with which it destroys its prey. At the extremity of each of these there is a small opening, and from thence extends a tube, through which it is supposed the centipede emits the poisonous fluid into the wound inflicted by these fangs.

Leeuwenhoek, desirous of ascertaining the influence of the poison, placed a large fly within reach of a centipede. He seized it between a pair of the middle feet, then passed it from one pair to the next, till it was brought under the fangs, which were plunged into its body, and it died instantly. St. Pierre says, that in the Isle of France his dog was bitten by one of them which was upwards of six inches in length, and that the wound turned to a kind of ulcer, which was three weeks in healing. He was highly diverted in observing one of them overcome by a vast number of ants, that attacked it in conjunction, and, after seizing it by all its legs, bore it along as workmen would do a large piece of timber. Its poison is not more injurious than that of the scorpion, and seldom proves fatal to the larger animals.

CHAP. XI.

OF THE LEECH.

THE last of this wingless tribe that I shall mention is the Leech, which, like all the former, undergoes no varieties of transformation; but when once excluded from the body of the parent, preserves its first figure to the end. I place the history of the leech among the first class of insects; while I have degraded the Earth-worm, the *Tenia*, and the *Polypus*, into the class of zoophytes, or that imperfect tribe which serves to make the shade between animal and vegetable nature. Not but that the earth-worm or the polypus have their motions, their appetites, and their vital principles, as complete as the leech, and, to a cursory view, appear every way as complete animals. But there is one circumstance that lays the line between them; that exalts the one, and degrades the other. The

earth-worm and the polypus may be cut into pieces, and each piece will produce a new and perfect animal: the leech cannot suffer this dissection, but dies when cut in two; an evident instance that it is possessed of a more perfect organization than those animals which it otherwise very much resembles.

The leech, from its uses in medicine, is one of those insects that man has taken care to provide; but, of a great variety, one kind only is considered as serviceable. The horse-leech, which is the largest of all, and grows to four inches in length, with a glossy black surface, is of no use, as it will not stick to the skin; the snail-leech is but an inch in length; and though it will stick, is not large enough to extract a sufficient quantity of blood from the patient; the broad-tailed leech, which grows to an inch and a half in length, with the back raised into a sort of ridge, will stick but on very few occasions: it is the large brown leech, with a whitish belly, that is made use of in medicine, and whose history best merits our curiosity.

The leech has the general figure of a worm, and is about as long as one's middle finger. Its skin is composed of rings, by means of which it is possessed of its agility, and swims in water. It contracts itself, when out of water, in such a manner, that when touched it is not above an inch long. It has a small head, and a black skin, edged with a yellow line on each side, with some yellowish spots on the back. The belly also, which is of a reddish colour, is marked with whitish yellow spots. But the most remarkable part of this animal is the mouth, which is composed of two lips, that take whatever form the insect finds convenient. When at rest, the opening is usually triangular; and within it are placed three very sharp teeth, capable of piercing not only the human skin, but also that of a horse or an ox. Still deeper in the head is discovered the tongue, which is composed of a strong fleshy substance, and which serves to assist the animal in sucking, when it has inflicted its triple wound; for no sooner is this voracious creature applied to the skin, than it buries its teeth therein, then closes its lips round the wound which it has made; and thus, in the manner of a cupping-glass, extracts the blood as it flows to the different orifices.

In examining this animal's form farther towards the tail, it is seen to have a gullet and an intestinal canal, into which the blood flows in great abundance. On each side of this are seen running along several little bladders, which, when the animal is empty, seem to be filled with nothing but water; but when it is gorging blood, they seem to communicate with the intestines, and receive a large portion of the blood which flows into the body. If these bladders should be considered as so many stomachs, then every leech will be found to have twenty-four. But what is most extraordinary of all in this animal's

formation is, that though it takes so large a quantity of food, it has no anus or passage to eject it from the body when it has been digested. On the contrary, the blood which the leech has thus sucked remains for several months clotted within its body, blackened a little by the change, but no way putrefied, and very little altered in its texture or consistence. In what manner it passes through the animal's body, or how it contributes to its nourishment, is not easily accounted for. The water in which they are kept is very little discoloured by their continuance; they cannot be supposed to return the blood by the same passage through which it was taken in: it only remains, therefore, that it goes off through the pores of the body, and that these are sufficiently large to permit its exclusion.

But it is not in this instance alone that the leech differs from all other insects. It was remarked in a former chapter, that the whole insect tribe had the opening into their lungs placed in their sides, and that they breathe through those apertures as other animals through the mouth. A drop of oil poured on the sides of a wasp, a bee, or a worm, would quickly suffocate them, by stopping up the passages through which they breathe: but it is otherwise with the leech, for this animal may be immersed in oil without injury; nay, it will live therein; and the only damage it will sustain is, that, when taken out, it will be seen to cast a fine pellucid skin exactly of the shape of the animal, after which it is as alert and vigorous as before. It appears from hence that the leech breathes through the mouth; and, in fact, it has a motion that seems to resemble the act of respiration in more perfect animals: but concerning all this we are very much in the dark.

This animal seems to differ from all others in several respects: the rest of the reptile tribe are brought forth from eggs; the leech is viviparous, and produces its young, one after the other, to the number of forty or fifty at a birth. It is probable that, like the snail, each insect contains the two sexes, and that it impregnates and is impregnated in the same manner. The young ones are chiefly found in the month of July, in shallow running waters, and particularly where they are tepid by the rays of the sun. The large ones are chiefly sought after; and being put into a glass vessel filled with water, they remain for months, nay, for years, without taking any other subsistence.¹ But they never breed

in this confinement; and, consequently, what regards that part of their history still remains obscure.

In this part of the world they seldom grow to above four inches; but in America and the East they are found from six to seven. Their pools there abound with them in such numbers, that it would be dangerous bathing, if for no other consideration. Our sailors and soldiers, who the last war were obliged to walk in those countries through marshy grounds, talk with terror of the number of leeches that infested them on their march. Even in some parts of Europe they increase so as to become formidable. Sedelius, a German physician, relates, that a girl of nine years old, who was keeping sheep near the city of Bomst in Poland, perceiving a soldier making up to her, went to hide herself in a neighbouring marsh among some bushes; but the number of leeches was so great in that place, and they stuck to her so close, that the poor creature expired from the quantity of blood which she lost by their united efforts. Nor is this much to be wondered at, since one of those insects, which when empty generally weighs but a scruple, will, when gorged, weigh more than two drachms.

When leeches are to be applied, the best way is to take them from the water in which they are contained about an hour before, for they thus become more voracious, and fasten more readily. When saturated with blood, they generally fall off of themselves; but if it be thought necessary to take them from the wound, care should be used to pull them very gently, or even to sprinkle them with salt, if they continue to adhere: for if they be plucked rudely away, it most frequently happens that they leave their teeth in the wound, which makes a very troublesome inflammation, and is often attended with danger. If they be slow in fixing to the part, they are often enticed by rubbing it with milk or blood, or water mixed with sugar. As salt is a poison to most insects, many people throw it upon the leech when it has dropped from the

habitation with amazing swiftness, and seldom rests until it begins to blow hard. If a remarkable storm of thunder and rain is to succeed, for some days before it lodges almost continually out of the water, and discovers great uneasiness in violent throes and convulsive-like motions. In frost, as in clear summer-like weather, it lies constantly at the bottom, and in snow, as in rainy weather, it pitches its dwelling on the very mouth of the phial. It may not be amiss to note that the leech is kept in a common eight-ounce glass phial, about three-fourths filled with water, and covered on the mouth with a bit of linen rag. In the summer time the water is changed once a-week, and in the winter, once a-fortnight. What reasons may be assigned for these changes philosophy may determine; but the leech appears to be affected in a way analogous to that of spirits and mercury in a weather-glass; and it seems evident, from the surprising sensations which it manifests, that an approaching change of weather, even days before it takes place, makes a visible alteration upon its manner of living."—*Edinburgh Advertiser*.

¹ "I kept, says a gentleman, a phial of water, containing a leech, on the pane of my lower sash chamber window, so that when I looked in the morning I could know what would be the weather of the following day. If the weather continues serene and beautiful the leech lies motionless at the bottom of the glass, and rolled together in a spiral form. If it rains either before or after noon it is found to have crept up to the top of its lodging, and there it remains till the weather is settled. If we are to have wind, the poor prisoner moves through its limpid

wound, by which means it disgorges the blood it has swallowed, and it is then kept for repeated application. They seldom, however, stick after this operation; and as the price is but small, fresh leeches should always be applied whenever such application is thought necessary.²

² Considerable excitement has of late prevailed amongst the professional and unprofessional public, by the discovery of the fact that, for the last seven or eight years, the immense majority of leeches employed in France have been previously gorged with the blood of animals, in order to increase their weight and their price. M. Chevalier, Professor of the School of Pharmacy, and member of the Academy of Medicine, has published on this subject an interesting pamphlet, from which we extract the following passages:—"The ponds, which formerly furnished to France an abundant supply of leeches, have now been for some time completely exhausted by the avidity of the persons engaged in the traffic, who sold the youngest leeches, and thus left no chance of reproduction. France has been, for the last 18 years, obliged to obtain from foreign countries what her own fens might have given her; and it is from Egypt, Turkey, Wallachia, and more particularly Hungary and Russia, that she imports leeches. The extent of the trade may be judged of by the statement of the fact, that from the year 1827 to 1844, no less than 500,000,000 leeches have been imported into France; and, at the same time, the price of leeches has increased from 15 to 40c. a-piece. Wholesale dealers purchase them by the weight, and in order to increase their own profits, gorge the leeches with the blood of mammiferous animals—the sheep, the calf, the ox—for increase, so that a thousand middle-sized leeches, weight two pounds and a half, value 75f., are changed, by the addition of two pounds of blood, into large leeches, weighing four pounds and a half, and sold at 180 or 200f." M. Magendie, Professor Royer Collard, Dr. Louis Barth, and many other distinguished members of the French faculty, have also investigated the subject, and fully concur with M. Chevalier in deprecating the fraud, in stating that the origin of the blood contained in the bodies of gorged leeches being unknown, may become the source of contagious diseases transmitted from animals to man, and in warning the public against an imposition alike injurious to commerce and to health.—*Medical Times*.

SUPPLEMENTARY NOTE.

Percival, in his description of the island of Ceylon, gives an account of a species of leech which is found in vast numbers in the marshes of that island. "One species of leech (he says), has left too deep an impression on my mind to be passed over unnoticed. Besides the leeches employed by apothecaries, to reduce tumours, and carry off corrupted blood, there is another species, which infests in immense numbers the woods and swampy grounds of Ceylon, particularly in the rainy season, to the great annoyance of every one who passes through them. The leeches of this species are very small, not being much bigger than a pin; and are of a dark speckled colour. In their motions they do not crawl like a worm, or like the leeches we are accustomed to see in Europe, but keep constantly springing, by first fixing their head

on a place, and bringing their tail up to it by a sudden jerk, while at the same time their head is thrown forward for another hold. In this manner they move so exceedingly quick, that before they are perceived, they contrive to get upon one's clothes, when they immediately endeavour by some aperture to find an entrance to the skin. As soon as they reach it they begin to draw blood; and as they can effect this even through the light clothing worn in this climate, it is almost impossible to pass through the woods and swamps in rainy weather without being covered with blood. On our way to Candy, in marching through the narrow paths among the woods, we were terribly annoyed by these vermin; for whenever any of us sat down or even halted for a moment, we were sure to be immediately attacked by multitudes of them; and before we could get rid of them our gloves and boots were filled with blood. This was attended with no small danger; for if a soldier were from drunkenness or fatigue to fall asleep on the ground, he must have perished by bleeding to death. On rising in the morning I have often found my bed-clothes and skin covered with blood in an alarming manner. The Dutch, in their marches into the interior, at different times lost several of their men; and on our setting out, they told us we should hardly be able to make our way for them. But though we were terribly annoyed, we all escaped without any serious accident. Other animals, as well as man, are subject to the attacks of these leeches. Horses in particular, from their excessive plunging and kicking to get rid of these creatures when they fasten upon them, render it very unsafe for any one to ride through the woods of the interior."

M. Gay, in a letter to M. de Blainville, from Chili, dated 5th July, 1835, says: "It is a remarkable circumstance, that here all the leeches exist in the woods, and never in the water; and, indeed, I cannot botanize without having my legs severely punctured by them. They crawl on plants, trunks of trees, and shrubs, never approaching marshes or rivers; and the only one which I have been fortunate enough to discover in such localities is a very small species of *Branchiolla*, which inhabits the pulmonary cavity of *Avicula Dombeii*; it was while dissecting this molluscous animal that I detected it. I have discovered another species in the neighbourhood of Santiago, which lives on the gills of the *Astacus*. An equally interesting fact, and which deserves your attention, is the tendency exhibited by reptiles to become viviparous in these southern regions. Almost all those which I have dissected presented this remarkable circumstance. Not only does the harmless adder of Valdivia give birth to a living progeny, but likewise all the beautiful Iguanas allied to the genus *Leposoma* of M. Spix, and which, on account of their beautiful colours, I have in the meantime termed *Chrysosaurus*. All the species which I have examined, including those which at Santiago deposit eggs, have without exception presented this phenomenon, and I may hence be allowed to generalize. The Batrachians have also furnished me some examples of this description, although in general they are oviparous. Nevertheless, a genus resembling the *Rhinella* of Fitzinger, and of which several species, rather prettily marked, form part of my collection, is constantly viviparous, and therefore increases the proofs of a fact, which is rendered more remarkable by the circumstance that all the examples occur within a radius of two or three leagues only."

BOOK II.

INSECTS OF THE SECOND ORDER.

CHAP. I.

OF THE SECOND ORDER OF INSECTS.

IN the former part we gave a concise history of the most considerable insects that without wings were produced in a perfect state; either from the body of the parent alive like quadrupeds, or from the egg in the manner of birds. We come now to a second order of insects, that are produced from the egg, like the former, but not in a perfect state; for when first excluded, they are without wings. This, however, does not hinder the exercise of their animal functions; the insect, although not yet come to perfection, walks, leaps, and eats; nor is it ever deprived of motion, only that it rests a little when it is about to cast that part of its skin previous to its state of perfection. It is then seen to assume two wings, which, like a budding flower, burst through the case that contained them, and the animal becomes a winged insect in its state of highest perfection. To this order we may refer the Libella or Dragon-fly, the Formica Leo or Lion-ant, the Grasshopper, the Locust, the Cricket, the Wood-cricket, the Mole-cricket, the Flea-locust, the Flying-bug, the Tipula, the Water-scorpion, the Notonecta or Water-fly, and many others.

CHAP. II.

OF THE LIBELLA, OR DRAGON-FLY.

OF all the flies which adorn or diversify the face of nature, these are the most various and the most beautiful; they are of all colours; green, blue, crimson, scarlet, white: some unite a variety of the most vivid tints, and exhibit in one animal more different shades than are to be found in the rainbow. They are called, in different parts of the kingdom, by different names; but none can be at a loss to know them, as they are distinguished from all other flies by the length of their bodies, by the largeness of their eyes, and the beautiful transparency of their wings, which are four in number. They are seen in summer flying with great rapidity near every hedge, and by every running brook; they sometimes settle on the leaves of plants, and sometimes keep for hours together on the wing.

Dragon-flies, though there are three or four

different kinds, yet agree in the most striking parts of their history, and one account may serve for all. The largest sort are generally found from two to three inches long; their tail is forked; their body divided into eleven rings; their eyes are large, horny, and transparent, divided by a number of intersections; and their wings, that always lie flat when they are at rest, are of a beautiful glossy transparency; sometimes shining like silver, and sometimes glistening like gold. Within the mouth are to be seen two teeth covered with a beautiful lip: with these the creatures bite fiercely when they are taken; but their bite is perfectly harmless, as I have experienced more than once.

These insects, beautiful as they are, are produced from eggs, which are deposited in the water, where they remain for some time without seeming life or motion. They are ejected by the female into the water by clusters, like a bunch of grapes, where they sink to the bottom by their natural weight, and continue in that state till the young ones find strength enough to break the shell, and to separate from each other. The form in which they first show life is that of a worm with six legs, bearing a strong resemblance to the dragon-fly in its winged state, except that the wings are yet concealed within a sheath peculiar to this animal. The rudiments of these appear in bunches on the back, within which the wings are folded up into each other, while all the colours and varieties of painting appear transparent through the skin. These animals, upon quitting the egg, still continue in the water, where they creep and swim, but do not move swiftly. They have likewise a sharp sight, and immediately sink to the bottom, if any one comes to the places where they live, or whenever they perceive the least uncommon object. Their food at that time is soft mud and the glutinous earthy substances that are found at the bottom.

When these animals prepare to change from their reptile to their flying state, they then move out of the water to a dry place; as into grass, to pieces of wood, stone, or anything else they meet with. They there firmly fix their acute claws; and, for a short time, continue quite immovable, as if meditating on the change they are to undergo. It is then observed, that the skin first opens on the head and back; and out of this opening they exhibit their real head and eyes, and at length their six legs; whilst in the meantime, the hollow and empty skin, or slough of their legs, remains firmly fixed in its place. Af-

ter this, the enclosed creature creeps forward by degrees; and by this means draws first its wings and then its body out of the skin; and proceeding a little farther, sits at rest for some time, as if immovable. During this time the wings, which were moist and folded, begin by degrees to expand themselves, and to make smooth and even all those plaits which were laid against each other, like a closed fan. The body is likewise insensibly extended, until all the limbs have obtained their proper size and dimensions. All these surprising and difficult operations are accomplished by the force of the blood and the circulating humours. The creature cannot at first make use of its new wings, and therefore is forced to stay in the same place until all its limbs are dried by the circumambient air. It soon, however, begins to enter upon a more noble life than it had hitherto led in the bottom of the brook; and from creeping slowly and living accidentally, it now wings the air, and makes choice from amidst the variety of its provisions.

Indeed, no animal is more amply fitted for motion, subsistence, and enjoyment. As it hunts and seeks after its food flying in the air, nature has provided it with two large eyes, which make almost the whole head, and which resemble glittering mother-of-pearl. It has also four expansive silver-coloured wings, with which, as with oars, it can turn itself with prodigious velocity; and to assist these, it is furnished with a very long body, which, like a rudder, directs its motions. As the wings are long, and the legs short, they seldom walk, but are ever seen either resting or flying. For this reason, they always choose dry branches of trees or shrubs to remain on; and when they have refreshed themselves a little, they renew their flight. Thus they are seen adorning the summer with a profusion of beauty, lightly traversing the air in a thousand directions, and expanding the most beautiful colours to the sun. The garden, the forest, the hedges, and the rivulets, are animated by their sports; and there are few who have been brought up in the country, who have not employed a part of their childhood in the pursuit.

But while these beautiful flies appear to us so idly and innocently employed, they are in fact the greatest tyrants of the insect tribe; and, like the hawk among birds, are only hovering up and down to seize their prey. They are the strongest and the most courageous of all winged insects; nor is there one, how large soever, that they will not attack and devour. The blue-fly, the bee, the wasp, and the hornet, make their constant prey; and even the butterfly, that spreads so large a wing, is often caught and treated without mercy. Their appetite seems to know no bounds; they spend the whole day in the pursuit, and have been seen to devour three times their own size in the capture of a single hour. They seize their prey flying with their six claws, and tear it easily to pieces with their

teeth, which are capable of inflicting troublesome wounds.

But the males are upon the wing for another purpose beside that of food, as they are very salacious, and seek the females with great ardour. The sun no sooner begins to warm the fields, than the males are found assiduously employed each in seeking its mate; and no sooner does a female appear but two or three males are seen pursuing and endeavouring to seize her with all their arts and agility. The instrument of generation in the male is placed very different from that of any other insect, being not at the end of the tail, as in others, but immediately under the breast, and consequently, at first view, incapable of being united to the sexual part of the female; which, as in other insects, lies in the tail. To perform this junction, nature has provided the male with a very peculiar manner of proceeding. As soon as he perceives the female, and finds himself sufficiently near, he seizes upon the back of her head by surprise, and fastening his claws upon her, turns round his forky tail, which he fastens round her neck, and in this manner fixes himself so closely and firmly, that no efforts can remove him. It is in vain that she flies from one branch to another, and settles upon them, he still keeps fixed, and often continues in this situation for three or four hours successively. When he flies, she is obliged to fly with him; but he still directs the way: and though she moves her wings, she seems entirely guided by his motion. As yet, however, the business of impregnation is not performed; for to this the female must contribute; and she at last seems, by the continuance of her constraint, to comply: for, turning up the end of her tail to that part of the breast of the male in which lies the part proper for generation, both instruments meet, and the eggs of the female receive the necessary fecundation. An hour or two after this she flies to some neighbouring pool, where she deposits her eggs, as was already mentioned. There they continue in a reptile state for a year; and then are changed into a beautiful fly, resembling the parent.

SUPPLEMENTARY NOTE.

During the grub-state of the dragon-fly, it preys with the most savage ferocity on all aquatic insects. It is likewise, at this period, furnished with an apparatus at the end of the body, by which it can suck up and eject water with such considerable force, that the stream is perceptible to the distance of two or three inches from their bodies. If they are kept some time out of water, the desire or necessity of respiration is augmented: and accordingly, when replaced in a vessel filled with water, inspirations and respirations are repeated with unusual force and frequency.

The *Depressed dragon-fly*, the general manners or habits of which resemble those of its cogeners, is of so different a colour in the different sexes, that the shape is the chief criterion of the species. The body of the male is of a bright blue, with brown marginal variegations, while that of the female, on the con-

trary, is of a bright yellow, with similar marginal markings. Like the *libellula grandis*, this species is principally seen towards the decline of summer, and flies with great rapidity about the neighbourhood of brooks and stagnant waters. It differs much from other species of this genus, from the body being much flattened.

The *Black-winged dragon-fly* is one of the most common species in this country, and is generally seen flying, during the morning hours, about the banks of rivers or stagnant waters. The general colour of the body is deep blue-green, while the wings are marked in the middle by a very large patch or area of bluish black. The insect varies, however, in point of colour, more than any other species, and is sometimes seen with the wings perfectly plain or unmarked, and sometimes, on the contrary, entirely blue-black: the tinge of the body also varies in a similar manner, being either bright golden-green, deep livid blue, or sometimes brown.

CHAP. III.

OF THE FORMICA LEO, OR LION-ANT.

ALTHOUGH this animal properly belongs to no order of insects, yet as it is changed into a fly very much resembling that described in the preceding chapter, it may not be improper to give its history here. If we consider the life of this animal, in its different stages of existence, we shall find it equally wonderful in all; but as it changes to a dragon-fly, what we have said of that animal above, need not be repeated here. The lion-ant, when it becomes an inhabitant of air, in every respect resembles that which has already been described; its glossy wings, its voracious appetites, its peculiar manner of generation are entirely the same. It is in its reptile state that it differs from all other insects; and in that state it will be amusing to pursue its history.

The lion-ant, in its reptile state, is of the size of a common wood-louse, but somewhat broader. It has a pretty long head and a roundish body, which becomes a little narrower towards the tail. The colour is a dirty gray, speckled with black, and the body is composed of several flat rings, which slip one upon another. It has six feet, four of which are fixed to the breast, and two to the neck. The head is small and flat, and before there are two little smooth horns or feelers, which are hard, about a quarter of an inch long, and crooked at the ends. At the basis of the feelers there are two small black lively eyes, by which it can see the smallest object, as is easily discovered by its starting from every thing that approaches.

To a form so unpromising, and so ill provided for the purposes of rapacity, this animal unites the most ravenous appetites in nature; but to mark its imbecility still stronger, as other animals have wings or feet to enable them to advance towards their prey, the lion-ant is unprovided with such assistance from either. It has legs, indeed; but these only enable it to run back-

ward, so that it could as soon die as make the smallest progressive motion. Thus famished and rapacious as it ever seems, its prey must come to it, or rather into the snare provided for it, or the insidious assassin must starve.

But Nature, that has denied it strength or swiftness, has given it an equivalent in cunning, so that no animal fares more sumptuously without stirring from its retreat. For this purpose, it chooses a dry sandy place at the foot of a wall, or under some shelter, in order to preserve its machinations from the rain. The driest and most sandy spot is the most proper for it; because a heavy clogged earth would defeat its labour. When it goes about to dig the hole where it takes its prey, it begins to bend the hinder part of its body, which is pointed, and thus works backward; making, after several attempts, a circular furrow, which serves to mark out the size of the hole it intends making, as the ancients marked out the limits of a city with a plough. Within this first furrow it digs a second, then a third, and afterwards others, which are always less than the preceding. Then it begins to deepen its hole, sinking lower and lower into the sand, which it throws with its horns or feelers towards the edges, as we see men throw up sand in a gravel-pit. Thus, by repeating its labours all round, the sand is thrown up in a circle about the edge of the pit, until the whole is quite completed. This hole is always formed in a perfect circle; and the pit itself resembles the inside of an inverted funnel.¹ When this insect first

¹ It frequently happens in the course of its labours, sometimes even when they are near a close, that it will meet with a stone of some size which would, if suffered to remain, injure materially the perfection of its trap. But such obstacles as this do not prevent the insect from proceeding: on the contrary, it redoubles its assiduity to remove the obstruction, as M. Bonnet repeatedly witnessed. If the stone be small, it can manage to jerk it out in the same manner as the sand; but when it is two or three times larger and heavier than its own body, it must have recourse to other means of removal. The larger stones it usually leaves till the last, and when it has removed all the sand which it intends, it then proceeds to try what it can do with the less manageable obstacles. For this purpose, it crawls backwards to the place where a stone may be, and thrusting its tail under it, is at great pains to get it properly balanced on its back, by an alternate motion of the rings composing its body. When it has succeeded in adjusting the stone, it crawls up the side of the pit with great care, and deposits its burden on the outside of the circle. Should the stone happen to be round, the balance can be kept only with the greatest difficulty, as it has to travel with its load upon a slope of loose sand which is ready to give way at every step; and often when the insect has carried it to the very brink it rolls off its back and tumbles down to the bottom of the pit. This accident, so far from discouraging the ant-lion, only stimulates it to more persevering efforts. Bonnet observed it renew these attempts to dislodge a stone, five or six times. It is only when it finds it utterly impossible to succeed, that it abandons the design, and commences another pit in a fresh situation. When it succeeds in getting a stone beyond the line of its

leaves the egg and is newly hatched, the first pit it makes is very small; but as it grows bigger, it makes a larger hole; which is destined, like a pit-fall, to entrap its prey. It is generally about two inches deep, and as much in diameter.

The work being thus, with great labour, finished, the insidious insect places itself in ambush, hiding itself in the bottom under the sand, in such a manner, that its two horns encircle the bottom of the pit. All the sides of this pitfall are made of the most loose and crumbling materials; so that scarce any insect can climb up that has once got down to the bottom. Conscious of this, the lion-ant remains in patient expectation, ready to profit by that accident which throws some heedless little animal into its den. If then, by misfortune, an ant, a wood-louse, or a small caterpillar, walks too near the edge of the precipice, the sand gives way beneath them, they fall to the bottom of the pit, where they meet inevitable destruction. The fall of a single grain of sand gives the murderer notice at the bottom of its cave; and it never fails to sally forth to seize upon its prey. It happens sometimes, however, that the ant or the wood-louse is too nimble, and runs up the sides of the pitfall before the other can make ready to seize it. The lion-ant has then another contrivance, still more wonderful than the former; for, by means of its broad head and feelers, it has a method of throwing up a shower of sand which falls upon the struggling captive with tremendous weight, and once more crushes it down to the bottom. When the insect is once fallen thus low, no efforts can relieve or release it; the lion-ant seizes it with its feelers, which are hollow, and darting them both into its body, sucks out all the little animal's juices with the utmost rapacity.

When the prey is thus reduced to a husk, and nothing but the external form remains, the next care of the murderer is to remove the body from its cell; since the appearance of dead carcasses might forewarn other insects of the danger of the place. The insect, therefore, takes up the wasted trunk with its feelers, and throws it, with wonderful strength, at least six inches from the edge of its hole; and then patiently sets about mending the breaches which its fortifications had received in the last engagement. Nothing can abate its industry, its vigilance, its patience, or its rapacity. It will work for a week together to make its pitfall; it will continue upon the watch for more than a month, patiently expecting the approach of its prey; and if it comes in greater quantities than is needful, yet still the little voracious creature will quit the insect it has newly killed, and leave it half-eaten, to kill and attack any other that happens to fall within the sphere of its malignity; though so voracious, it is surprisingly patient of hunger; circle, it is not content with letting it rest there; but to prevent it from again rolling in, it goes on to push it to a considerable distance.—Ed.

some of them having been kept in a box with sand, for six months and upwards, without feeding at all.

When the lion-ant attains a certain age, in which it is to change into another form, it then leaves off its usual rapacious habits, but keeps on its industry. It no longer continues to make pits, but furrows up the sand all around in an irregular manner: testifying those workings and violent agitations which most insects exhibit previous to their transformation. These animals are produced in autumn, and generally live a year, and perhaps two, before they assume a winged form. Certain it is, that they are found at the end of winter of all sizes; and it would seem that many of the smaller kinds had not yet attained to sufficient maturity for transformation. Be this as it may, when the time of change approaches, if the insect finds its little cell convenient, it seeks no other; if it is obliged to remove, after furrowing up the sand, it hides itself under it, horns and all.—It there spins a thread, in the manner of the spider; which being made of a glutinous substance, and being humid from the moisture of its body, sticks to the little particles of sand among which it is spun; and in proportion as it is thus excluded, the insect rolls up its web, sand and all, into a ball, of which itself is the centre. This ball is about half an inch in diameter; and within it the insect resides, in an apartment sufficiently spacious for all its motions. The outside is composed of sand and silk; the inside is lined with silk only, of a fine pearl-colour, extremely delicate, and perfectly beautiful. But though the work is so curious within, it exhibits nothing to external appearance but a lump of sand; and thus escapes the search of birds that might otherwise disturb the inhabitant within.

The insect continues thus shut up for six weeks or two months; and gradually parts with its eyes, its feelers, its feet, and its skin; all which are thrust into a corner of the inner apartment, like a rag. The insect then appears almost in its winged state, except that there is a thin skin which wraps up the wings, and that appears to be nothing else but a liquor dried on their outside. Still, however, the little animal is too delicate and tender to venture from its retreat; but continues enclosed for some time longer: at length, when the members of this new insect have acquired the necessary consistence and vigour, it tears open its lodging, and breaks through its wall. For this purpose it has two teeth, like those of grasshoppers, with which it eats through, and enlarges the opening, till it gets out. Its body, which is turned like a screw, takes up no more than the space of a quarter of an inch; but when it is unfolded, it becomes half an inch in length; while its wings, that seemed to occupy the smallest space, in two minutes unfold, and become longer than the body. In short, it becomes a large and beautiful fly, of

the libellula kind, with a long slender body, of a brown colour; a small head, with large bright eyes, long slender legs, and four large transparent reticulated wings. The rest of its habits resemble that insect whose form it bears; except, that instead of dropping its eggs in the water, it deposits them in sand, where they are soon hatched into that rapacious insect so justly admired for its method of catching its prey.

CHAP. IV.

OF THE GRASSHOPPER, THE LOCUST, THE CICADA,
THE CRICKET, AND THE MOLE-CRICKET.

BELONGING to the second order of insects, we find a tribe of little animals, which, though differing in size and colour, strongly resemble each other in figure, appetites, nature, and transformation. But though they all appear of one family, yet man has been taught to hold them in different estimation; for while some of this tribe amuse him with their chirpings, and banish solitude from the fields, others come in swarms, eat up everything that is green, and in a single night, convert the most delightful landscape into a dreary waste. However, if these animals be separately considered, the devouring locust is not, in the least, more mischievous than the musical grasshopper; the only difference is, that one species comes for food in a swarm, the other feeds singly.

That animal which is called the grasshopper with us, differs greatly from the cicada of antiquity; for as our insect is active enough in hopping through the long grass, from whence it has taken its name, the cicada had not this power, but either walked or flew. The little hissing note also of our grasshopper is very different from the song of the cicada, which was louder, and far more musical. The manner in which this note is produced by the two animals is very different; for the cicada makes it by a kind of buckler, which the male has beneath its belly; the grasshopper, by a transparent membrane that covers a hole at the base of its wings. There is still a greater variety in all these with regard to shape and colour. Some are green, some black, some livid, and some variegated; but many of them do not show all their colours till they fly. Some have long legs, some short, some with more joints, others with fewer. Some sing, others are mute; some are innocent, doing no damage to the husbandman; while others do such prodigious mischief, that they are looked upon, in some countries, as one of the terrible scourges of the incensed Divinity.

Of this variegated tribe, the little grasshopper that breeds in such plenty in every meadow, and that continues its chirping through the summer, is best known to us; and by having its history,

we shall be possessed of that of all the rest. This animal is of the colour of green leaves, except a line of brown which streaks the back, and two pale lines under the belly and behind the legs. It may be divided into the head, the corslet, and the belly. The head is oblong, regarding the earth, and bearing some resemblance to that of a horse. Its mouth is covered by a kind of round buckler jutting over it, and armed with teeth of a brown colour, hooked at the points. Within the mouth is perceivable a large reddish tongue, and fixed to the lower jaw. The feelers or horns are very long, tapering off to a point; and the eyes are like two black specks, a little prominent. The corslet is elevated, narrow, armed above and below by two serrated spines. The back is armed with a strong buckler, to which the muscles of the legs are firmly bound, and round these muscles are seen the vessels by which the animal breathes as white as snow. The last pair of legs are much longer and stronger than the first two pair, fortified by thick muscles, and very well formed for leaping. It has four wings; the anterior ones springing from the second pair of legs, the posterior from the third pair. The hinder wings are much finer, and more expansive, than the foremost, and are the principal instruments of its flight. The belly is considerably large, composed of eight rings, and terminated by a forked tail, covered with down like the tail of a rat. When examined internally, besides the gullet, we discover a small stomach; and behind that a very large one, wrinkled and furrowed withinside: lower down there is till a third; so that it is not without reason that all the animals of this order are said to chew the cud, as they so much resemble ruminant animals in their internal conformation.

A short time after the grasshopper assumes its wings, it fills the meadow with its note; which, like that among birds, is a call to courtship.¹

¹ We shall here, by way of variety, lay before the reader two exquisite sonnets on the grasshopper and the cricket by two kindred poets.

I.

THE poetry of earth is never dead;—

When all the birds are faint with the hot sun
And hide in cooling trees, a voice will run
From hedge to hedge about the new-mown mead;
That is the Grasshopper's;—he takes the lead
In summer luxury,—he has never done
With his delights; for when tired out with fun
He rests at ease beneath some pleasant weed.
The poetry of earth is ceasing never!—
On a lone winter evening, when the frost
Has wrought a silence, from the stove there shrills
The Cricket's song, in warmth increasing ever,
And seems to one, in drowsiness half lost,
The Grasshopper's among some grassy hills.—Keats.

II.

GREEN little vaulter in the sunny grass,
Catching your heart up at the feel of June,
Sole voice left stirring midst the lazy noon,
When e'en the bees lag at the summoning brass;—
And you, warm little housekeeper, who class
With those who think the candles come too soon,
Loving the fire, and with your tricksome tune
Nick the glad silent moments as they pass;—
O sweet and tiny cousins, that belong,
One to the fields, the other to the hearth,
Both have your sunshine; both though small are strong
At your clear hearts; and both were sent on earth
To ring in thoughtful ears this natural song,
—In doors and out,—summer and winter—Mirth.—Bunt.

The male only of this tribe is vocal; and upon examining at the base of the wings, there will be found a little hole in its body, covered with a fine transparent membrane. This is thought by Linnæus to be the instrument it employs in singing: but others are of opinion the sound is produced by rubbing its hinder legs against each other: however this be, the note of one male is seldom heard, but it is returned by another; and the two little animals, after many mutual insults of this kind, are seen to meet and fight desperately. The female is generally the reward of victory; for, after the combat, the male seizes her with his teeth behind the neck, and thus keeps her for several hours till the business of fecundation is performed. They are at that time so strongly united, that they can scarcely be separated without tearing asunder. Towards the latter end of autumn the female prepares to deposit her burden; and her body is then seen greatly distended with her eggs, which she carries to the number of a hundred and fifty. In order to make a proper lodgment in the earth for them, Nature has furnished her with an instrument at her tail, somewhat resembling a two-edged sword, which she can sheathe and unsheathe at pleasure: with this she pierces the earth as deep as she is able; and into the hole which her instrument has made, she deposits her eggs, one after the other.²

² "The ovipositor, or auger (*tariere*), as Reaumur calls it, is lodged in a sheath which lies in a groove of a terminating ring of the belly. It requires only a very slight pressure to cause the instrument to protrude from its sheath, when it appears to the naked eye to be of an equal thickness throughout, except at the point, where it is somewhat enlarged and angular, and on both sides finely indented with teeth. A more minute examination of the sheath demonstrates that it is composed of two horny pieces slightly curved, and ending in the form of an elongated spoon, the concave part of which is adapted to receive the convex end of the ovipositor. When the protruded instrument is further examined with a microscope, the denticulations, nine in number on each side, appear strong, and arranged with great symmetry, increasing in fineness towards the point, where there are three or four very small ones, beside the nine that are more obvious. The magnifier also shows that the instrument itself, which appeared simple to the naked eye, is in fact composed of three different pieces, two exterior armed with the teeth before-mentioned, denominated by Reaumur files, (*limes*) and another pointed like a lancet, and not denticulated. The denticulated pieces moreover are capable of being moved forwards and backwards, while the centre one remains stationary, and as this motion is effected by pressing a pin or the blade of a knife over the muscles on either side at the origin of the ovipositor, it may be presumed that those muscles are destined for producing similar movements when the insect requires them. By means of a finely pointed pin, carefully introduced between the pieces, and pushed very gently downwards, they may be, with no great difficulty, separated in their whole extent. The contrivance, by which those three pieces are held united, while at the same time the two files can be easily put in motion, are similar to some of our own mechanical inventions, with this difference,

Having thus provided for the continuation of her posterity, the animal herself does not long survive; but as the winter approaches, she dries up, seems to feel the effects of age, and dies from a total decay. Some, however, assert, that she is killed by the cold: and others, that she is eaten by worms: but certain it is, that neither the

that no human workman could construct an instrument of this description so small, fine, exquisitely polished, and fitting so exactly. We should have been apt to form the grooves in the central piece, whereas they are scooped out in the handles of the files, and play upon two projecting ridges in the central piece, by which means this is rendered stronger. M. Reaumur discovered that the best manner of showing the play of this extraordinary instrument is to cut it off with a pair of scissors near its origin, and then, taking it between the thumb and the finger at the point of section, work it gently to put the files in motion. Beside the muscles necessary for the movement of the files, the handle of each is terminated by a curve of the same hard horny substance as itself, which not only furnishes the muscles with a sort of lever, but serves to press as with a spring, the two files close to the central piece, as is shown in the lower figure.

"M. Pontedera, who studied the economy of the tree-hoppers with some care, was anxious to see the insect itself make use of the ovipositor in forming grooves in wood, but found it was so shy and easily alarmed, that it took to flight whenever he approached; a circumstance of which Reaumur takes advantage, to soothe his regret that the insects were not indigenous in his neighbourhood. But of their workmanship when completed, he had several specimens sent to him from Provence and Languedoc by the Marquis de Caumont. The gall-flies when about to deposit their eggs, select growing plants and trees, but the tree-hoppers on the contrary, make choice of dead, dried branches, for the mother seems to be aware that moisture would injure her progeny. The branch, commonly a small one, in which eggs have been deposited, may be recognised by being covered with little oblong elevations caused by small splinters of the wood, detached at one end, but left fixed at the other by the insect. These elevations are for the most part in a line, rarely in a double line, nearly at equal distances from each other, and form a lid to a cavity in the wood about four lines in length, containing from four to ten eggs. It is to be remarked, that the insect always selects a branch of such dimensions, that it can get at the pith, not because the pith is more easily bored, for it does not penetrate into it at all, but to form a warm and safe bed for the eggs. M. Pontedera says, that when the eggs have been deposited, the insect closes the mouth of the hole with a gum capable of protecting them from the weather; but M. Reaumur thinks this only a fancy, as out of a great number which he examined, he could discover nothing of the kind. Neither is such a protection wanted; for the woody splinters above-mentioned furnish a very good covering. The grubs hatched from these eggs (of which, M. Pontedera says, one female will deposit from five to seven hundred) issue from the same holes through which the eggs have been introduced, and betake themselves to the ground to feed on the roots of plants. They are not transformed into chrysalides, but into active nymphs, remarkable for their fore limbs, which are thick, strong, and furnished with prongs for digging; and when we are told by Dr. Le Fevre, that they make their way easily into hard stiff clay, to the depth of two or three feet, we perceive how necessary to them such a conformation must be."—*Insect Architecture*.

male nor female are ever seen to survive the winter. In the meantime the eggs which have been deposited continue unaltered, either by the severity of the season or the retardation of the spring. They are of an oval figure, white, and of the consistence of horn; their size nearly equals that of a grain of anise: they are enveloped in the body within a covering, branched all over with veins and arteries; and when excluded they crack, on being pressed between the fingers; their substance within is a whitish, viscous, and transparent fluid. In this manner they remain deposited beneath the surface of the earth during the whole winter; till the genial return of spring begins to vivify and hatch them. The sun, with its warmth, beginning to animate all nature, the insect eggs feel its benign influence; and generally, about the beginning of May, every egg produces an insect about the size of a flea. These, at first, are of a whitish colour; at the end of two or three days they turn black; and soon after they become of a reddish brown.

They appear, from the beginning, like grasshoppers, wanting wings; and hop among the grass, as soon as excluded, with great agility.

Yet still they are by no means arrived at their state of full perfection, although they bear a strong resemblance to the animal in its perfect form. They want, or seem to want, the wings, which they are at last seen to assume; and can only hop among the grass, without being able to fly. The wings, however, are not wanting, but are concealed within four little bunches, that seem to deform the sides of the animal: there they lie rolled up in a most curious manner; and occupying a smaller space than one could conceive who saw them extended. Indeed, all insects, whatever transmutations they seem to undergo, are yet brought forth with those very limbs, parts, and wings, which they afterwards seem to acquire. In the most helpless caterpillar there is still to be seen the rudiments of that beautiful plumage which it afterwards expands when a butterfly: and though many new parts seem unfolded to the view, the animal acquires none but such as it was from the beginning possessed of. The grasshopper, therefore, though seemingly without wings, is in reality, from the first, possessed of those instruments, and only waits for sufficient force to break the bonds that hold them folded up, and to give them their full expansion.

The grasshopper, that, for above twenty days from its exclusion, has continued without the use of its wings, which were folded up to its body, at length prepares for its emancipation, and for a life of greater liberty and pleasure. To make the proper dispositions for the approaching change, it ceases from its grassy food, and seeks about for a convenient place beneath some thorn or thistle, that may protect it from an accidental shower. The same laborious writhings and workings, heavings and palpitations, which we have

remarked in every other insect upon an approaching change, are exhibited in this. It swells up its head and neck; it then seems to draw them in again; and thus alternately, for some time, it exerts its powers to get free. At length, the skin covering the head and breast is seen dividing above the neck; the head is seen issuing out first from the bursting skin; the efforts still continuing, the other parts follow successively; so that the little animal, with its long feelers, legs and all, works its way from the old skin, that remains fixed to the thistle or thorn. It is, indeed, inconceivable how the insect can thus extricate itself from so exact a sheath as that which covereth every part of its body.³

The grasshopper, thus disengaged from its outer skin, appears in its perfect form; but then so feeble, and its body so soft and tender, that it may be moulded like wax. It is no longer of that obscure colour which it exhibited before, but of a greenish white, which becomes more vivid as the moisture on the surface is dried away. Still, however, the animal continues to show no signs of life, but appears quite spent and fatigued with its labour for more than an hour together. During this time, the body is drying, and the wings unfolding to their greatest expansion; and the curious observer will perceive them, fold after fold, opening to the sun, till at last they become longer than the two hinder legs. The insect's body also is lengthened during this operation, and it becomes much more beautiful than before.

These insects are generally vocal in the midst of summer, and they are heard at sun-setting much louder than during the heats of the day. They are fed upon grass; and, if their belly be pressed, they will be seen to return the juices of the plants they have last fed upon. Though unwilling to fly, and slow in flight, particularly when the weather is moist or cool, they are sometimes seen to fly to considerable distances. If

³ A curious circumstance regarding the grasshopper is related in the 'American Quarterly Review.' The large winged grasshopper, which flutters with so much vivacity through our meadows during the autumn, feeds upon vegetable matter, and deposits its eggs upon vegetables for the purpose of being supported until matured. Before the grasshopper takes wing, another insect, the ichneumon, lights upon its body, and thrusts under its skin a number of its eggs, by means of a tubular awl-shaped oviduct. Those eggs slowly acquire perfection, become living worms, and feed upon the body of the hapless grasshopper, until themselves are ready to take wing. So admirably do they perform their office, that they do not injure the vital organs of the insect they are internally devouring, until they are just ready to change their state: and at the proper season, hundreds of grasshoppers, in this condition, have just strength enough remaining to flutter to a tree or fence, and with a dying effort fix their hooked feet so firmly as to retain their position long after death. Examine their bodies at this season, and you will find an empty shell or one filled with large and active worms, just ready to burst their coverings and become winged insects.—Ed.

they are caught by one of the hinder legs, they quickly disengage themselves from it, and leave the leg behind them. This, however, does not grow again, as with crabs or spiders; for as they are animals but of a single year's continuance, they have not sufficient time for repairing those accidental misfortunes. The loss of their leg also prevents them from flying; for being unable to lift themselves in the air, they have not room upon the ground for the proper expansion of their wings. If they be handled roughly, they will bite very fiercely; and when they fly, they make a noise with their wings. They generally keep in the plain, where the grass is luxuriant, and the ground rich and fertile: there they deposit their eggs, particularly in those cracks which are formed by the heat of the sun.

Such are the habits and nature of those little vocal insects that swarm in our meadows, and enliven the landscape. The larger kinds only differ from them in size, in rapidity of flight, and the powers of injuring mankind, by swarming upon the productions of the earth. The quantity of grass which a few grasshoppers that sport in the fields can destroy is trifling; but when a swarm of locusts, two or three miles long, and several yards deep, settle upon a field, the consequences are frightful. The annals of every country are marked with the devastation which such a multitude of insects produces; and though they seldom visit Europe in such dangerous swarms as formerly, yet, in some of the southern kingdoms, they are still formidable. Those which have, at uncertain intervals, visited Europe, in our memory, are supposed to have come from Africa, and the animal is called the Great brown locust. It was seen in several parts of England in the year 1748, and many dreadful consequences were apprehended from its appearance. This insect is about three inches long; and has two horns or feelers, an inch in length. The head and horns are of a brownish colour; it is blue about the mouth, as also on the inside of the larger legs. The shield that covers the back is greenish; and the upper side of the body brown, spotted with black, and the under side purple. The upper wings are brown, with small dusky spots, with one larger at the tips; the under wings are more transparent, and of a light brown, tinged with green, but there is a dark cloud of spots near the tips. This is that insect that has threatened us so often with its visitations; and that is so truly terrible in the countries where it is bred. There is no animal in the creation that multiplies so fast as these, if the sun be warm, and the soil in which their eggs are deposited be dry. Happily for us, the coldness of our climate, and the humidity of our soil, are no way favourable to their production; and as they are but the animals of a year, they visit us and perish.

The Scripture, which was written in a country where the locust made a distinguished feature

in the picture of nature, has given us several very striking images of this animal's numbers and rapacity. It compares an army, where numbers are almost infinite, to a swarm of locusts: it describes them as rising out of the earth, where they are produced; as pursuing a settled march to destroy the fruits of the earth, and co-operate with divine indignation.

When the locusts take the field, as we are assured, they have a leader at their head, whose flight they observe, and pay a strict attention to all his motions. They appear, at a distance, as a black cloud, which, as it approaches, gallops upon the horizon, and almost hides the light of the day. It often happens that the husbandman sees this imminent calamity pass away without doing him any mischief; and the whole swarm proceed onward, to settle upon the labour of some less fortunate country. But wretched is the district upon which they settle: they ravage the meadow and the pasture ground; strip the trees of their leaves, and the garden of its beauty. The visitation of a few minutes destroys the expectations of a year; and a famine but too frequently ensues. In their native tropical climate they are not so dreadful as in the more southern parts of Europe. There, though the plain be stripped of their verdure, the power of vegetation is so great, that an interval of three or four days repairs the calamity: but where verdure is the livery of a season; and we must wait till the ensuing spring repairs the damage. Besides, in their long flights to this part of the world, they are famished by the tediousness of their journey, and are, therefore, more voracious wherever they happen to settle. But it is not by what they devour that they do so much damage as by what they destroy. Their very bite is thought to contaminate the plant, and to prevent its vegetation. To use the expression of the husbandman, they burn whatever they touch, and leave the marks of their devastation for three or four years ensuing. But if they be not killed while living, they are still more so when dead; for wherever they fall, they infect the air in such a manner, that the smell is insupportable. Orosius tells us, that in the year of the world 3800, there was an incredible number of locusts which infected Africa; and, after having eaten up everything that was green, they flew off, and were drowned in the African sea; where they caused such a stench, that the putrefying bodies of hundreds of thousands of men could not equal it.

In the year 1690 a cloud of locusts was seen to enter Russia in three different places; from thence to spread themselves over Poland and Lithuania, in such astonishing multitudes that the air was darkened, and the earth covered with their numbers. In some places they were seen lying dead, heaped upon each other several feet deep; in others, they covered the surface like a black cloth: the trees bent beneath the

weight; and the damage which the country sustained exceeded computation. In Barbary their numbers are formidable, and their visits are frequent. In the year 1724, Dr. Shaw was a witness, in that country, of their devastations. Their first appearance was about the latter end of March, when the wind had been southerly for some time. In the beginning of April, their numbers were so vastly increased, that, in the heat of the day, they formed themselves into large swarms, which appeared like clouds, and darkened the sun. In the middle of May they began to disappear, retiring into the plains to deposit their eggs. In the next month, being June, the young brood began to make their appearance, forming many compact bodies of several hundred yards square; which afterwards marching forward, climbed the trees, walls, and houses, eating everything that was green in their way. The inhabitants, to stop their progress, laid trenches all over their fields and gardens, filling them with water. Some placed large quantities of heath, stubble, and such like combustible matter, in rows, and set them on fire on the approach of the locusts. But all this was to no purpose; for the trenches were quickly filled up, and the fires put out by the vast number of swarms that succeeded each other. A day or two after one of these was in motion, others that were just hatched came to glean after them, gnawing off the young branches and the very bark of the trees. Having lived near a month in this manner, they arrived at their full growth, and threw off their worm-like state, by casting their skins. To prepare themselves for this change, they fixed their hinder feet to some bush or twig, or corner of a stone, when immediately, by an undulating motion used on this occasion, their heads would first appear, and soon after the rest of their bodies.⁴ The whole transformation was performed

⁴ Mrs. Meredith thus describes the transformation of the locust in New South Wales. "In the summer evenings it is common to see upon the trunks of the trees, reeds, or any upright object, a heavy-looking, humpbacked brown beetle, an inch and a half long, with a scaly coat, clawed lobster-like legs, and a somewhat dirty aspect; which latter is easily accounted for by the little hole visible in the turf at the foot of the tree, whence he has lately crept. I have sometimes carried them home and watched with great interest the poor locust 'shuffle off his mortal' or rather earthly 'coil,' and emerge into a new world. The first symptom is the opening of a small slit which appears in the back of his coat, between the shoulders, through which as it slowly gapes wider, a pale, soft, silky-looking texture is seen, throbbing and heaving backwards and forwards. Presently a fine square head, with two light-red eyes, has disengaged itself, and in process of time (for the transformation goes on almost imperceptibly) this is followed by the liberation of a portly body and a conclusion; after which the brown leggings are pulled off like boots, and a pale, cream-coloured, weak, soft creature, very tenderly walks away from his former self, which remains standing entire, like the coat of mail of a warrior of old—the shelly plates of the eyes that are gone looking after their lost con-

in seven or eight minutes' time; after which, they were a little while in a languishing condition; but as soon as the sun and air had hardened their wings, and dried up the moisture that remained after casting off their sloughs, they returned again to their former greediness, with an addition both of strength and agility. But they did not continue long in this state before they were entirely dispersed; after laying their eggs, directing their course northward, they probably perished in the sea. It is said that the holes these animals make, to deposit their eggs, are four feet deep in the ground; the eggs are about fourscore in number, of the size of caraway comfits, and bundled up together in clusters.

It would be endless to recount all the mischiefs which these famished insects have at different times occasioned; but what can have induced them to take such distant flights, when they come into Europe, is not so easy to be accounted for. It seems most probable, that, by means of a very dry season in the heart of Africa, they are propagated in such numbers, that the vegetables of the spot where they are produced are not sufficient to sustain them. Thus being obliged to find out other countries, they traverse the sandy deserts, where they can find no sustenance: still meeting with nothing to allure them from their height, they proceed forward across the sea, and thus come into Europe, where they alight upon the first green pastures that occur.⁵

tents with a sad lack of 'speculation' in them. On the back of the new-born creature lie two small bits of membrane, doubled and crumpled up in a thousand puckers, like a Limerick glove in a walnut-shell; these now begin to unfold themselves—and gradually spread smoothly out into two large, beautiful opal-coloured wings, which by the following morning have become clearly transparent, while the body has acquired its proper hard consistency and dark colour; and when placed on a tree the happy thing soon begins its whirring, creaking, chirruping song, which continues with little intermission as long as its harmless happy life."—Mrs. Meredith's *Sketches of New South Wales*.

⁵ It is difficult to form an adequate conception of the swarms of locusts which, in 1797, invaded the interior of southern Africa, as recorded by Mr. Barrow. In the part of the country where he was, the whole surface of the ground, for an area of nearly two thousand square miles, might literally be said to be covered with them. The water of a very wide river was scarcely visible, on account of the dead carcasses of locusts that floated on the surface, drowned in the attempt to come at the reeds that grew in it. They had devoured every blade of grass, and every green herb, except the reeds. But they are not precisely without a choice in their food. When they attack a field of corn just come into ear, they first, according to Mr. Barrow, mount to the summit and pick out every grain before they touch the leaves and stem, keeping the while constantly in motion, with the same intent of destruction always in view. When the larvae, which are much more voracious than the perfect insects, are on a march during the day, it is utterly impossible to turn the direction of the troop, and this seems usually to correspond with that of the wind. Towards the setting

In some parts of the world the inhabitants turn what seems a plague to their own advantage. Locusts are eaten by the natives in many kingdoms of the East; and are caught in small

of the sun the march is discontinued, when the troop divides into companies that surround the small shrubs, or tufts of grass, or ant hills, in such thick patches, that they appear like so many swarms of bees; and in this manner they rest till daylight. At these times it is that the farmers have any chance of destroying them; this they sometimes effect by driving among them a flock of two or three thousand sheep, by whose restlessness great numbers of them are trampled to death. The year 1797 was the third of their continuance in Sneeuwberg; and their increase had been more than a million-fold from year to year. This district, however, had been entirely free from them for ten years preceding their visit in 1794. Their former exit was singular: all the full-grown insects were driven into the sea by a tempestuous north-west wind, and were afterwards cast up on the beach, where they formed a bank of three or four feet high, and extending to a distance of nearly fifty miles. When this mass became putrid, and the wind was at south-east, the stench was sensibly felt in several parts of Sneeuwberg, although distant at least a hundred and fifty miles.

Pallas gives a detailed account of the daily proceedings of the larvæ of the Italian locust. "In serene weather," he tells us, "the locusts are in full motion in the morning, immediately after the evaporation of the dew; and if no dew has fallen, they appear as soon as the sun imparts his genial warmth. At first, some are seen running about like messengers among the reposing swarms, which are lying partly compressed upon the ground at the side of small eminences, and partly attached to tall plants and shrubs. Shortly after the whole body begins to move forward in one direction, and with little deviation. They resemble a swarm of ants, all taking the same course, at small distances, but without touching each other: they uniformly travel towards a certain region as fast as a fly can run, and without leaping unless pursued; in which case, indeed, they disperse, but soon collect again and follow their former route. In this manner they advance from morning to evening without halting, frequently at the rate of a hundred fathoms, and upwards, in the course of a day. Although they prefer marching along high roads, foot-paths, or open tracts, yet, when their progress is opposed by bushes, hedges, and ditches, they penetrate through them: their way can only be impeded by the waters of brooks or canals, as they are apparently terrified at every kind of moisture. Often, however, they endeavour to gain the opposite bank, with the aid of overhanging boughs; and, if the stalks of plants or shrubs be laid across the water, they pass in close columns over these temporary bridges, on which they even seem to rest, and enjoy the refreshing coolness. Towards sunset, the whole swarm gradually collect in parties, and creep up the plants, or encamp on slight eminences. On cold, cloudy, or rainy days, they do not travel. As soon as they acquire wings, they progressively disperse, but still fly about in large swarms."

When Captains Irby and Mangles were travelling round the southern extremity of the Dead Sea, in the end of May, they had an opportunity of observing these insect depredators. "In the morning," say they, "we quitted Shobek. On our way we passed a swarm of locusts that were resting themselves in a gully; they were in sufficient numbers to alter apparently the colour of the rock on which they had alighted, and to make a sort of crackling noise

nets provided for that purpose. They parch them over the fire in an earthen pan; and when their wings and legs are fallen off, they turn reddish, of the colour of boiled shrimps. Dampier has eaten them thus prepared, and thinks them a tolerable dish. The natives of Barbary also eat them fried with salt; and they are said to taste like cray-fish.

There is a locust in Tonquin, about the bigness of the top of a man's finger, and as long as the first joint. It breeds in the earth, in low grounds; and in the months of January and February, which is the season for taking them, they issue from the earth in vast swarms. At first they can hardly fly, so that they often fall into the rivers in great numbers: however, the natives in these months watch the rivers, and take them up in multitudes in small nets. They either eat them fresh, broiled on the coals, or pickle them for keeping. They are considered as a great delicacy in that part of the world, as well by the rich as the poor. In the countries where they are eaten, they are regularly brought to market, and sold as larks or quails in Europe. They must have been a common food with the Jews, as Moses, in the book of Leviticus, permits them to eat four different kinds of this animal, which he takes care to specify. This dish, however, has not yet made its way into the kitchens

while eating, which we heard before we reached them. Volney compares it to the foraging of an army. Our conductors told us they were on their way to Gaza, and that they pass almost annually."

A curious sight to an European must have been one which Mr. Darwin witnessed in the Pampas in the shape of a flight of locusts: "After our two days' tedious journey, it was refreshing to see in the distance the rows of poplar and willows growing round the village and river of Luxan. Shortly before we arrived at this place, we observed to the south a ragged cloud of a dark reddish-brown colour. At first we thought that it was smoke from some great fire on the plains; but we soon found that it was a swarm of locusts. They were flying northward; and with the aid of a light breeze, they overtook us at the rate of ten or fifteen miles an hour. The main body filled the air from a height of twenty feet, to that, as it appeared, of two or three thousand above the ground; and the sound of their wings was as the sound of chariots of many horses running to battle: or rather, I should say, like a strong breeze passing through the rigging of a ship. The sky, seen through the advanced guard, appeared like a mezzotinto engraving, but the main body was impervious to sight; they were not, however, so thick together but that they could escape a stick waved backwards and forwards. When they alighted, they were more numerous than the leaves in the field, and the surface became reddish instead of being green: the swarm having once alighted, the individuals flew from side to side in all directions. Locusts are not an uncommon pest in this country: already during this season, several smaller swarms had come up from the south, where, as apparently in all other parts of the world, they are bred in the deserts. The poor cottagers in vain attempted by lighting fires, by shouts, and by waving branches to avert the attack. This species of locust closely resembles, and perhaps is identical with the famous *gryllus migratorius* of the East."—Ed.

of the luxurious in Europe; and though we may admire the delicacies of the East, we are as yet happily deprived of the powers of imitation.

Of all animals, however, of this noxious tribe, the Great West Indian locust, individually considered, is the most formidable. It is about the thickness of the barrel of a goose-quill, and the body is divided into nine or ten joints; in the whole, about six or seven inches long. It has two small eyes standing out of the head, like those of crabs; and two feelers, like long hair. The whole body is studded with small excrescences, which are not much bigger than the points of pins. The shape is roundish, and the body diminishes in circumference to the tail, which is forked into two horns. Between these, there is a sort of a sheath containing a small dangerous sting. If any person happens to touch this insect, he is sure to be stung; and is immediately taken with a shivering and trembling all over the body; which, however, may soon be put a stop to, by rubbing the place that was affected with a little palm oil.⁶

From the locust we descend to the Cricket, which is a very inoffensive and pretty animal. Though there be a species of this insect that lives entirely in the woods and fields, yet that with which we are best acquainted is the House-cricket, whose voice is so well known behind a country fire in a winter's evening. There is something so unusual in hearing a sound while we do not see the animal producing it, nor discover the place from whence it comes, that, among the country people, the chirping of the cricket is always held ominous; and whether it deserts the fire-side, or pays an unexpected visit, the credulous peasantry always find something to be afraid of. In general, however, the killing of a cricket is considered as a most unlucky omen: and though their company is not much desired, yet no methods must be taken to remove them.⁷

⁶ It is now known that every insect of this tribe is perfectly harmless.—ED.

⁷ Towards sunset is the time when the field-cricket begins to appear out of their subterranean habitations. They are, however, so shy and cautious, that it is no easy matter to get a sight of them; for, feeling a person's footstep as he advances, they stop short in the midst of their song, and retire backward nimbly into their burrows, where they lurk till all suspicion of danger is over. Mr. White, of Selborne, who attentively studied their habits and manners, at first made an attempt to dig them out with a spade, but without any great success; for either the bottom of the hole was inaccessible, from its terminating under a large stone, or else in breaking up the ground the poor creature was inadvertently squeezed to death. Out of one thus bruised, a great number of eggs were taken; which were long and narrow, of a yellow colour, and covered with a very tough skin. More gentle means were then used, and these proved successful. A pliant stalk of grass gently insinuated into the caverns, will probe their windings to the bottom, and bring out the inhabitant; and thus the humane inquirer may gratify his curiosity, without injuring the object of it. It is re-

The cricket very much resembles the grasshopper in its shape, its manner of ruminating, its voice, its leaping, and methods of propagation. It differs in its colour, which is uniformly of a rusty brown; in its food, which is more various; and in its place of residence, which is most usually in the warmest chinks behind a country hearth. They are in some measure obliged to the bad masonry employed in making peasants' houses for their retreats. The smallest chink serves to give them shelter; and where they once make their abode they are sure to propagate. They are of a most chilly nature, seldom leaving the fireside; and, if undisturbed, are seen to hop from their retreats to chirrup at the blaze in the chimney. The wood-cricket is the most timorous animal in nature; but the chimney-cricket, being used to noises, disregards not only those, but the appearance of people near it. Whether the voice of this animal is formed in the same manner with that of the grasshopper, by a fine membrane at the base of the wings, which is moved by a muscle, and which being coiled up, gives a sound like a quail-pipe, is not yet ascertained; nor do we well know the use of this voice, since anatomical inspection has not yet been able to discover the smallest organs of hearing. Still, however, we can make no doubt of their power of distinguishing sounds, though probably not in the same manner with the more perfect ranks of nature. Certain it is, that I have often heard them call, and this call was as regularly answered by another, although none but the males are vocal.

markable that, though these insects are furnished with long legs behind, and brawny thighs, adapted for leaping, yet when driven from their holes, they show no activity, but crawl away in so lifeless a manner as easily to be caught. And though they are provided with a curious apparatus of wings, yet they never exert them, even when there seems to be the greatest occasion. The males only make their shrill noise, perhaps out of rivalry and emulation; as is the case with many animals, which exert some sprightly note during their breeding time. When the males meet, they occasionally fight very fiercely, as Mr. White found by some that he put into the crevices of a dry stone wall, where he wished to have them settle. For though they seemed distressed by being taken out of their knowledge, yet the first that got possession of the chinks seized on all that were obtruded upon them, with a vast row of serrated fangs. With their strong jaws toothed like the shears of a lobster's claws, they perforate and round their curious regular cells, having no fore-claws to dig with like the mole-cricket. When taken into the hand they never attempt to defend themselves, though armed with so formidable weapons. Of such herbs as grow about the mouths of their burrows, they eat indiscriminately; and never in the daytime seem to stir more than two or three inches from their home. Sitting in the entrance of their caverns, they chirp in the night, as well as day, from the middle of the month of May to the middle of July. In hot weather, when they are most vigorous, they make the hills echo; and, in the more still hours of darkness, may be heard to a very considerable distance.—ED.

As the cricket lives chiefly in the dark, so its eyes seem formed for the gloominess of its abode; and those who would surprise it, have only to light a candle unexpectedly; by which it is dazzled, and cannot find the way back to its retreat. It is a very voracious little animal, and will eat bread, flour, and meat; but it is particularly fond of sugar. They never drink, but keep for months together at the back of the chimney, where they could possibly have had no moisture. The warmth of their situation only serves to increase their mirth and loquacity. Except in the very coldest weather, they never cease their chirruping, but continue that little piercing note, which is as pleasing to some as it is disagreeable to others. The great Scaliger was particularly delighted with the chirruping of crickets, and kept several of them for his amusement, enclosed in a box, which he placed in a warm situation. Others, on the contrary, think there is something ominous and melancholy in the sound, and use every endeavour to banish this insect from their houses. Ledelius tells us of a woman who was very much incommoded by crickets, and tried, but in vain, every method of banishing them from her house. She at last accidentally succeeded; for having one day invited several guests to her house, where there was a wedding, in order to increase the festivity of the entertainment, she procured drums and trumpets to entertain them. The noise of these was so much greater than what the little animals were used to, that they instantly forsook their situation, and were never heard in that mansion more.

But of all the cricket kind, that which is called the Mole cricket is the most extraordinary. This animal is the largest of all the insects with which we are acquainted in this country, being two inches and a half in length, and three quarters of an inch in breadth. The colour is of a dusky brown; and at the extremity of the tail there are two hairy excrescences, resembling, in some sense, the tail of a mouse. The body consists of eight scaly joints, or separate folds; is brown on the upper part, and more deeply tinged below. The wings are long, narrow, and terminate in a sharp point, each having a blackish line running down it: however, when they are extended, they appear to be much broader than could at first sight be supposed. The shield of the breast is of a firm texture, of a blackish colour, and hairy. The fore-feet, which are the animal's principal instruments of burrowing in the earth, are strong, webbed, and hairy; it generally, however, runs backward; but it is commonly under ground, where it burrows even faster than a mole. It is thought also to be amphibious, and capable of living under water, as well as under ground.

Of all insects this is the most detested by gardeners, as it chiefly resides in that ground which lies light, and where it finds sufficient plenty under the surface. Thus, in a single night's time

it will run along a furrow, which has been newly sown, and rob it of all its contents. Its legs are formed in such a manner that it can penetrate the earth in every direction; before, behind, and above it. At night it ventures from its underground habitation, and, like the cricket, has its chirping call. When the female is fecundated, she makes a cell of clammy earth, the inside of which is large enough to hold two hazel-nuts; and in this she lays her eggs. The whole nest is about the size of a common hen's egg, closed up on every side, and well defended from the smallest breath of air. The eggs generally amount to the number of a hundred and fifty, being white, and about the size of a caraway comfit. They are thus carefully covered, as well to defend them from the injuries of the weather, as from the attacks of the black-beetle; that being itself an under-ground inhabitant, would, but for this precaution, devour or destroy them. To prevent this, the female mole-cricket is often posted as a sentinel near the nest; and when the black invader plunges in to seize its prey, the guardian insect seizes him behind, and instantly bites him in two.

Nothing can exceed the care and assiduity which these animals exhibit in the preservation of their young. Wherever the nest is placed, there seems to be a fortification, avenues, and intrenchments, drawn round it: there are numberless winding-ways that lead to it, and a ditch drawn about it, which few of its insect enemies are able to pass. But their care is not confined to this only; for at the approach of winter they carry their nest entirely away, and sink it deeper in the ground, so that the frost can have no influence in retarding the young brood from coming to maturity. As the weather grows milder, they raise their magazine in proportion; till, at last, they bring it as near the surface as they can, to receive the genial influence of the sun, without wholly exposing it to view; yet should the frost unexpectedly return, they sink it again as before.⁸

CHAP. V.

OF THE EARWIG, THE PROTH INSECT, AND SOME OTHERS BELONGING TO THE SECOND ORDER OF INSECTS.

WE should still keep in memory, that all insects of the second order, though not produced quite

⁸ Among this tribe may be numbered the Great Lantern-fly of Peru, an insect the most splendid and luminous of all that are yet known. In the head is contained a phosphorescent light, sufficiently vivid to serve the purposes of a candle in a dark room; or when two or three are put together at the end of a stick, to light travellers on the road like a lantern. It is about the size of a larger kind of locust, and the wings and whole body are beautifully variegated.—Ed.

perfect from the egg, yet want very little of their perfection, and require but a very small change to arrive at that state which fits them for flight and generation. The natural functions in these are never suspended: from the instant they leave the egg, they continue to eat, to move, to leap, and pursue their prey: a slight change ensues; a skin, that enclosed a part of their body and limbs, bursts behind, like a woman's stays, and gives freedom to a set of wings, with which the animal expatiates, and flies in pursuit of its mate.

Of all this class of insects, the earwig undergoes the smallest change. This animal is so common, that it scarce needs a description: its swiftness in the reptile state is not less remarkable than its indefatigable velocity when upon the wing. That it must be very prolific appears from its numbers; and that it is very harmless, every one's experience can readily testify. It is provided with six feet, and two feelers; the tail is forked; and with this it often attempts to defend itself against every assailant. But its attempts are only the threats of impotence; they draw down the resentment of powerful animals, but no way serve to defend it. The deformity of its figure, and its slender make, have also subjected it to an imputation, which, though entirely founded in prejudice, has more than once produced its destruction. It is supposed, as the name imports, that it often enters into the ears of people sleeping; thus causing madness from the intolerable pain, and soon after death itself. Indeed, the French name which signifies the Ear-piercer, urges the calumny against the harmless insect in very plain terms; yet nothing can be more unjust: the ear is already filled with a substance which prevents any insect from entering; and besides, it is well lined and defended with membranes, which would keep out any little animal, even though the ear-wax were away. These reproaches, therefore, are entirely groundless: but it were well if the accusations which gardeners bring against the earwig were as slightly founded. There is nothing more certain than that it lives among flowers, and destroys them. When fruit also has been wounded by flies, the earwig generally comes in for a second feast, and sucks those juices which they first began to broach. Still, however, this insect is not so noxious as it would seem; and seldom is found but where the mischief has been originally begun by others. Like all of this class, the earwig is hatched from an egg. As there are various kinds of this animal, so they choose different places to breed in: in general, however, they lay their eggs under the bark of plants, or in the clefts of trees, when beginning to decay. They proceed from the egg in that reptile state in which they are most commonly seen; and, as they grow larger, the wings bound under the skin begin to bourgeon. It is amazing how very little room four large wings take up before they are pro-

truded; for no person could ever conceive such an expansion of natural drapery could be rolled up in so small a packet. The sheath in which they are enveloped, folds and covers them so neatly, that the animal seems quite destitute of wings;¹ and even when they are burst from their confinement, the animal, by the power of the muscles and joints which it has in the middle of its wings, can closely fold them into a very narrow compass. When the earwig has become a winged insect, it flies in pursuit of the female, ceasing to feed, and is wholly employed in the business of propagation. It lives in its winged state but a few days; and having taken care for the continuance of posterity, dries up, and dies to all appearance consumptive.²

To this order of insects we may also refer the Cuckoo Spit, or Froth Worm, that is often found hid in that frothy matter which we find on the surface of plants. It has an oblong obtuse body; and a large head with small eyes. The external wings, for it has four, are of a dusky brown, marked with two white spots: the head is black. The spume in which it is found wallowing is all of its own formation, and very much resembles frothy spittle. It proceeds from the vent of the animal, and other parts of the body; and if it be wiped away, a new quantity will be quickly seen ejected from the little animal's body. Within this spume it is seen in time to acquire four tubercles on its back, wherein the wings are enclosed: these bursting, from a reptile it becomes a winged animal; and thus rendered perfect, it flies to meet its mate, and propagate its kind.

The Water-tipula also belongs to this class. It has an oblong slender body, with four feet fixed upon the breast, and four feelers near the mouth. It has four weak wings, which do not at all seem proper for flying, but leaping only. But what this insect chiefly demands our attention for, is the wonderful lightness wherewith it runs on the surface of the water, so as scarce to put it in motion. It is sometimes seen in rivers, and on their banks, especially under shady trees; and generally in swarms of several together.

The Common Water-fly also breeds in the same manner with those above-mentioned. This animal is by some called *Notonecta*, because it does not swim, in the usual manner, upon its belly, but on its back: nor can we help admiring that fitness in this insect for its situation, as it feeds on the under-side of plants which grow on the surface of the water; and therefore it is thus formed with its mouth upwards, to take its food with greater convenience and ease.

We may also add the Water-scorpion, which is a large insect, being near an inch in length, and about half an inch in breadth. Its body is

¹ Swammerdam, p. 114.

² The indefatigable M. de Geer has discovered that the female earwig sits over her eggs, and fosters her young in the same manner as a hen does her chickens.—Ed.

nearly oval, but very flat and thin; and its tail long and pointed. The head is small; and the feelers appear like legs, resembling the claws of a scorpion, but without sharp points. This insect is generally found in ponds; and is, of all others, the most tyrannical and rapacious. It destroys, like a wolf among sheep, twenty times as many as its hunger requires. One of these, when put into a basin of water, in which were thirty or forty worms of the libellula kind, each as large as itself, destroyed them all in a few minutes; getting on their backs, and piercing with its trunk through their body. These animals, however, though so formidable to others, are nevertheless themselves greatly overrun with a little kind of louse, about the size of a nit, which very probably repays the injury which the water-scorpion inflicts upon others.

The water-scorpions live in the water by day: out of which they rise, in the dusk of the evening, into the air, and so flying from place to place often betake themselves, in quest of food, to other waters. The insect, before its wings are grown, remains in the place where it was produced; but when come to its state of perfection, sallies forth in search of a companion of the other sex, in order to continue its noxious posterity.

CHAP. VI.

OF THE EPHEMERA.

THE last insect we shall add to the second order is the Ephemera; which, though not strictly belonging to it, yet seems more properly referred to this rank than any other. Indeed, we must not attend to the rigour of method in a history where Nature seems to take delight to sport in variety.

That there should be a tribe of flies whose duration extends but to a day, seems at first surprising; but the wonder will increase, when we are told, that some of this kind seem to be born and to die in a space of a single hour. The reptile, however, from which they are bred, is by no means so short-lived; but is sometimes seen to live two years, and many times three years together.

All ephemeræ, of which there are various kinds, are produced from the egg in the form of worms; from whence they change into a more perfect form; namely, that of aurelias, which is a kind of middle state between a worm and a fly; and from thence they take their last mutation, which is into a beautiful fly, of longer or shorter duration, according to its kind.

The ephemera, in its fly state, is a very beautiful winged insect, and has a strong similitude to the butterfly, both from its shape and its wings. It is about the size of a middling butterfly; but its wings differ in not being covered

with the painted dust with which those of butterflies are adorned, and rendered opaque, for they are very transparent, and very thin. These insects have four wings, the uppermost of which are much the largest; when the insect is at rest, it generally lays its wings one over the other, on the back. The body is long, being formed of six rings, that are larger at the origin than near the extremity; and from this a tail proceeds, that is longer than all the rest of the fly, and consists sometimes of three threads of an equal length, or sometimes of two long and one short. To acquire this beautiful form, the insect has been obliged to undergo several transmutations; but its glory is very short-lived, for the hour of its perfection is the hour of its death; and it seems scarcely introduced to pleasure, when it is obliged to part with life.

The reptile that is to become a fly, and that is granted so long a term, when compared to its latter duration, is an inhabitant of the water, and bears a very strong resemblance to fishes, in many particulars; having gills by which it breathes at the bottom, and also the tapering form of aquatic animals. These insects have six scaly legs, fixed on their corslet. Their head is triangular: the eyes are placed forward, and may be distinguished by their largeness and colour. The mouth is furnished with teeth; and the body consists of six rings; that next the corslet being largest, but growing less and less to the end: the last ring is the shortest, from which the three threads proceed, which are as long as the whole body. Thus we see that the reptile bears a very strong resemblance to the fly; and only requires wings to be very near its perfection.

As there are several kinds of this animal, their aurelias are consequently of different colours; some yellow, some brown, and some cream-coloured. Some of these also bore themselves cells at the bottom of the water, from which they never stir out, but feed upon the mud composing the walls of their habitation, in contented captivity; others, on the contrary, range about, go from the bottom to the surface, swim between two waters, quit that element entirely to feed upon plants by the river side, and then return to their favourite element for safety and protection.

The reptile, however, though it lives two or three years, offers but little, in its long duration, to excite curiosity: it is hid at the bottom of the water, and feeds almost wholly within its narrow habitation. The most striking facts command our attention during the short interval of its fly state; into which it crowds the most various transactions of its little life. It then may be said to be in a hurry to live, as it has but so small a time to exist. The peculiar sign whereby to know that these reptiles will change into flies in a short time, consists in a protuberance of the wings on the back. About that time the smooth

depressed form of the upper part of the body changed into a more swollen and rounder shape; so that the wings are, in some degree, visible through the external sheath that covers them. As they are not natives of England, he would see them in their greatest abundance at walk, about sunset, along the banks of the Seine, or the Seine near Paris; where, for about five days, in the midst of summer, he will be astonished at their numbers and assiduity. The deepest descent of the flakes of snow in winter is not to equal their number: the whole air is alive with the new-born race; and the earth itself is all over covered with their remains. The aurelias, or reptile insects, that are, as yet, beneath the surface of the water, wait only for the approach of evening to begin their transformation. The most industrious shake off their old garments about eight o'clock; and those who are the most tardy, are transformed before nine. We have already seen that the operation of change in other insects is laborious and painful; with these nothing seems shorter, or performed with greater ease. The aurelias are suddenly lifted above the surface of the water, in their old sheathing-skin bursts; and through the cavity which is thus formed, a fly issues, whose wings, at the same instant, are unfolded, and, at the same time, lift it into the air. Millions and millions of aurelias, rise in this manner to the surface; and at once become flies, fill every quarter with their flutterings. All these sports are shortly to have an end; as the little strangers live but an hour or two, the whole swarm soon falls to the ground, covers the earth, like a deep snow, for several hundred yards, on every side of the river. Their numbers are then incredible, and every insect they touch becomes fatal to them; for they instantly die if they hit even against each other.

At this time the males and females are very differently employed. The males, quite inactive, apparently without desires, seem only born idle: no way like the males of other insects, they neither follow the opposite sex, nor bear enmity to each other: after fluttering for an hour or two, they drop upon land, without waiting to receive wings for scarce any other purpose but to satisfy an idle curiosity. It is likewise with the females; they have scarce time to get from the surface of the water, and have not their wings, but they hasten to drop their burden back again. If they happen also to flutter upon land, they deposit their burden in the place

where they drop. But then it may be demanded, where, and in what manner, are these eggs fecundated, as no copulation whatever appears between the sexes in their transitory visits in air? Swammerdam is of opinion, that they are impregnated in the manner of fish-spawn, by the male, after being ejected by the female; but, beside that this doctrine is exploded even from the history of fishes, it is certain that the males have not time for this operation, as the eggs drop to the bottom the instant they are laid on the water. Reaumur is of opinion that they copulate; but that the act bears a proportion in shortness to the small duration of their lives; and, consequently must be so soon performed as to be scarcely visible. This, however, is at best forcing a theory; and it is probable, that as there are many insects known to breed without any impregnation from the male, as we have already seen in mussels and oysters, and shall hereafter see in the gnat, and a species of the beetle, so the ephemera may be of this number. Be this as it may, the females are in such haste to deposit their eggs, that multitudes of them fall to the ground; but the greatest part are laid in the water. As they flutter upon the surface, two clusters are seen issuing from the extremity of their body, each containing about three hundred and fifty eggs, which make seven hundred in all. Thus, of all insects, this appears to be the most prolific; and it would seem that there was a necessity for such a supply, as, in its reptile state, it is the favourite food of every kind of fresh-water fish. It is in vain that these little animals form galleries at the bottom of the river, from whence they seldom remove; many kinds of fish break in upon their retreats, and thin their numbers. For this reason fishermen are careful to provide themselves with these insects, as the most grateful bait; and thus turn the fish's rapacity to its own destruction.

But though the usual date of those flies is two or three hours at farthest, there are some kinds that live several days; and one kind in particular, after quitting the water, has another case or skin to get rid of. These are often seen in the fields and woods distant from the water; but they are more frequently found in its vicinity. They are often found sticking upon walls and trees; and frequently with the head downwards, without changing place, or having any sensible motion. They are then waiting for the moment when they shall be divested of their last incommodious garment, which sometimes does not happen for two or three days together.

BOOK III.

INSECTS OF THE THIRD ORDER.

CHAP. I.

OF CATERPILLARS IN GENERAL.

IF we take a cursory view of insects in general, caterpillars alone, and the butterflies and moths they give birth to, will make a third part of the number. Wherever we move, wherever we turn, these insects, in one shape or another, present themselves to our view. Some, in every state, offer the most entertaining spectacle; others are beautiful only in their winged form. Many persons, of which number I am one, have an invincible aversion to caterpillars and worms of every species: there is something disagreeable in their slow crawling motion, for which the variety of their colouring can never compensate. But others feel no repugnance at observing, and even handling, them with the most attentive application.

There is nothing in the butterfly-state so beautiful or splendid as these insects. They serve, not less than the birds themselves, to banish solitude from our walks, and to fill up our idle intervals with the most pleasing speculations. The butterfly makes one of the principal ornaments of oriental poetry; but in those countries, the insect is larger and more beautiful than with us.

The beauties of the fly may, therefore, very well excite our curiosity to examine the reptile. But we are still more strongly attached to this tribe from the usefulness of one of the number. The silk-worm is, perhaps, the most serviceable of all other animals; since, from its labours, and the manufacture attending it, near a third part of the world are clothed, adorned, and supported.

Caterpillars may be easily distinguished from worms or maggots, by the number of their feet; and by their producing butterflies or moths. When the sun calls up vegetation, and vivifies the various eggs of insects, the caterpillars are the first that are seen upon almost every vegetable and tree, eating its leaves, and preparing for a state of greater perfection. They have feet both before and behind; which not only enable them to move forward by a sort of steps made by their fore and hinder parts, but also to climb up vegetables, and to stretch themselves out from the boughs and stalks to reach their food at a distance. All of this class have from eight feet, at the least, to sixteen; and this may serve to distinguish them from the worm-tribe, that never have so many. The animal into which they are converted is always a butterfly or moth; and

these are always distinguished from other flies, by having their wings covered over with a painted dust, which gives them such various beauty. The wings of flies are transparent, as we see in the common flesh-fly; while those of beetles are hard, like horn: from such, the wing of a butterfly may be easily distinguished; and words would obscure their differences.

From hence it appears, that caterpillars, whether in the reptile state, or advanced to their last state of perfection into butterflies, may easily be distinguished from all other insects; being animals peculiarly formed, and also of a peculiar nature. The transmutations they undergo are also more numerous than those of any insect hitherto mentioned; and, in consequence, they have been placed in the third order of changes by Swammerdam, who has thrown such lights upon this part of natural history. In the second order of changes, mentioned before, we saw the grasshopper and the earwig, when excluded from the egg, assume a form very like that which they were after to preserve; and seemed arrived at a state of perfection, in all respects, except in not having wings; which did not bud forth until they were come to maturity. But the insects of this third order, that we are now about to describe, go through a much greater variety of transformations; for when they are excluded from the egg, they assume the form of a small caterpillar, which feeds and grows larger every day, often changing its skin, but still preserving its form. When the animal has come to a certain magnitude in this state it discontinues eating, makes itself a covering or husk, in which it remains wrapped up, seemingly without life or motion; and after having, for some time, continued in this state, it once more bursts its confinement, and comes forth a beautiful butterfly. Thus we see this animal put on no less than three different appearances from the time it is first excluded from the egg. It appears as a crawling caterpillar; then an insensible aurelia, as it is called, without life or motion; and, lastly, a butterfly, variously painted according to its different kind. Having thus distinguished this class of insects from all others, we will first survey their history in general; and then enter particularly into the manners and nature of a few of them, which most deserve our curiosity and attention.

CHAP. II.

OF THE TRANSFORMATION OF THE CATERPILLAR INTO ITS CORRESPONDING BUTTERFLY OR MOTH.

WHEN winter has disrobed the trees of their leaves, Nature then seems to have lost her insects. There are thousands of different kinds, with and without wings, which, though swarming at other seasons, then entirely disappear. Our fields are re-peopled, when the leaves begin to bud, by the genial influence of spring; and caterpillars, of various sorts, are seen feeding upon the promise of the year, even before the leaves are completely unfolded. Those caterpillars, which we then see, may serve to give us a view of the general means which nature employs to preserve such a number of insects during that season, when they can no longer find subsistence. It is known, by united experience, that all these animals are hatched from the eggs of butterflies; and those who observe them more closely, will find the fly very careful in depositing its eggs, in those places, where they are likely to be hatched with the greatest safety and success. During winter, therefore, the greatest number of caterpillars are in an egg-state; and in this lifeless situation brave all the rigours and the humidity of the climate; and though often exposed to all its changes, still preserve the latent principle of life, which is more fully exerted at the approach of spring. That same power that pushes forth the budding leaf and the opening flower, impels the insect into animation; and nature at once seems to furnish the guest and the banquet. When the insect has found force to break its shell, it always finds its favourite aliment provided in abundance before it.

But all caterpillars are not sent off from the egg in the beginning of spring; for many of them have subsisted during the winter in their aurelia state; in which, as we have briefly observed above, the animal is seemingly deprived of life and motion. In this state of insensibility, many of these insects continue during the rigours of winter; some enclosed in a kind of shell, which they have spun for themselves at the end of autumn; some concealed under the bark of trees; others in the chinks of old walls; and many buried under ground. From all these, a variety of butterflies are seen to issue in the beginning of spring; and adorn the earliest part of the year with their painted flutterings.

Some caterpillars do not make any change whatsoever at the approach of winter; but continue to live in their reptile state through all the severity of the season. These choose themselves some retreat, where they may remain undisturbed for some months together; and there they remain, quite motionless, and as insensible as if they were actually dead. Their constitution is such, that food at that time would be useless;

and the cold prevents their making those dissipations which require restoration. In general, caterpillars of this kind are found in great numbers together, enclosed in one common web, that covers them all, and serves to protect them from the injuries of the air.

Lastly, there are some of the caterpillar kind, whose butterflies live all the winter; and who, having fluttered about for some part of the latter end of autumn, seek for some retreat during the winter, in order to answer the ends of propagation at the approach of spring. These are often found lifeless and motionless in the hollows of trees or the clefts of timber; but by being approached to the fire, they recover life and activity, and seem to anticipate the desires of the spring.

In general, however, whether the animal has subsisted in an egg-state, during the winter; or whether as a butterfly, bred from an aurelia, in the beginning of spring; or a butterfly that has subsisted during the winter, and lays eggs as soon as the leaves of plants are shot forward; the whole swarm of caterpillars are in motion to share the banquet that nature has provided. There is scarcely a plant that has not its own peculiar insects; and some are known to support several of different kinds. Of these, many are hatched from the egg, at the foot of the tree, and climb up to its leaves for subsistence; the eggs of others have been glued by the parent butterfly to the leaves; and they are no sooner excluded from the shell, but they find themselves in the midst of plenty.

When the caterpillar first bursts from the egg, it is small and feeble; its appetites are in proportion to its size, and it seems to make no great consumption; but as it increases in magnitude, it improves in its appetites; so that, in its adult caterpillar state, it is the most ravenous of all animals whatsoever. A single caterpillar will eat double its own weight of leaves in a day, and yet seem no way disordered by the meal. What would mankind do, if their oxen or their horses were so voracious?

These voracious habits, with its slow crawling motion, but still more a stinging like that of nettles, which follows upon handling the greatest number of them, make these insects not the most agreeable objects of human curiosity. However, there are many philosophers who have spent years in their contemplation; and who have not only attended to their habits and labours, but minutely examined their structure and internal conformation.

The body of the caterpillar, when anatomically considered, is found composed of rings, whose circumference is pretty near circular or oval. They are generally twelve in number, and are all membranaceous; by which caterpillars may be distinguished from many other insects, that nearly resemble them in form. The head of the caterpillar is connected to the first ring by the neck; that is generally so short and contracted,

that it is scarcely visible. All the covering of the head in caterpillars seems to consist of a shell; and they have neither upper nor under jaw, for they are both placed rather vertically, and each jaw armed with a large thick tooth, which is singly equal to numbers. With these the animals devour their food in such amazing quantities; and with these, some of the kind defend themselves against their enemies. Though the mouth be kept shut, the teeth are always uncovered; and while the insect is in health they are seldom without employment. Whatever the caterpillar devours, these teeth serve to chop it into small pieces, and render the parts of the leaf fit for swallowing. Many kinds, while they are yet young, eat only the succulent part of the leaf, and leave all the fibres untouched; others, however, attack the whole leaf, and eat it clean away. One may be amused, for a little time, in observing the avidity with which they are seen to feed; some are seen eating the whole day; others have their hours of repast; some choose the night, and others the day. When the caterpillar attacks a leaf, it places its body in such a manner that the edge of the leaf shall fall between its feet, which keeps it steady while the teeth are employed in cutting it: these fall upon the leaf somewhat in the manner of a pair of gardener's shears; and every morsel is swallowed as soon as cut. Some caterpillars feed upon leaves so very narrow, that they are not broader than their mouths; in this case the animal is seen to devour it from the point, as we would eat a radish.

As there are various kinds of caterpillars, the number of their feet are various; some having eight, and some sixteen. Of these feet the six foremost are covered with a sort of shining gristle; and are therefore called the shelly legs. The hindmost feet, whatever be their number, are soft and flexible, and are called membranaceous. Caterpillars also, with regard to their external figure, are either smooth or hairy. The skin of the first kind is soft to the touch, or hard like shagreen; the skin of the latter is hairy, and as it were thorny; and generally, if handled, stings like nettles. Some of them even cause this stinging pain if but approached too nearly.

Caterpillars, in general, have six small black spots placed on the circumference of the fore ring, and a little to the side of the head. Three of these are larger than the rest, and are convex and transparent: these Reaumur takes to be the eyes of the caterpillar; however, most of these reptiles have very little occasion for sight, and seem only to be directed by their feeling.

But the parts of the caterpillar's body which most justly demand our attention, are the stigmata, as they are called; or those holes on the sides of its body, through which the animal is supposed to breathe. All along this insect's body, on each side, these holes are easily discoverable. They are eighteen in number, nine

on a side, rather nearer the belly than the back; a hole for every ring, of which the animal's body is composed, except the second, the third, and the last. These oval openings may be considered as so many mouths, through which the insect breathes; but with this difference, that as we have but one pair of lungs, the caterpillar has no less than eighteen. It requires no great anatomical dexterity to discover these lungs in the larger kind of caterpillars: they appear, at first view, to be hollow cartilaginous tubes, and of the colour of mother-of-pearl. These tubes are often seen to unite with each other; some are perceived to open into the intestines; and some go to different parts of the surface of the body. That these vessels serve to convey the air, appears evidently, from the famous experiment of Malpighi; who, by stopping up the mouths of the stigmata with oil, quickly suffocated the animal, which was seen to die convulsed the instant after. In order to ascertain his theory, he rubbed oil upon other parts of the insect's body, leaving the stigmata free; and this seemed to have no effect upon the animal's health, but it continued to move and eat as usual: he rubbed oil on the stigmata of one side, and the animal underwent a partial convulsion but recovered soon after. However, it ought to be observed, that air is not so necessary to these as to the nobler ranks of animals, since caterpillars will live in an exhausted receiver for several days together; and though they seem dead at the bottom, yet when taken out, recover, and resume their former vivacity.

If the caterpillar be cut open longitudinally along the back, its intestines will be perceived running directly in a straight line from the mouth to the anus. They resemble a number of small bags opening into each other; and strengthened on both sides by a fleshy cord by which they are united. These insects are, upon many occasions, seen to cast forth the internal coat of their intestines with their food, in the changes which they so frequently undergo.—But the intestines take up but a small part of the animal's body, if compared to the fatty substance in which they are involved. This substance changes its colour when the insect's metamorphosis begins to approach; and from white it is usually seen to become yellow. If to these parts we add the caterpillar's implements for spinning, (for all caterpillars spin at one time or another,) we shall have a rude sketch of this animal's conformation: however, we shall reserve the description of those parts, till we come to the history of the silkworm, where the manner in which these insects spin their webs, will most properly find a place.

The life of a caterpillar seems one continued succession of changes, and it is seen to throw off one skin only to assume another; which also is divested in its turn: and thus for eight or ten times successively. We must not, however, con-

found this changing of the skin with the great metamorphosis which it is afterwards to undergo. The throwing off one skin, and assuming another, seems, in comparison, but a slight operation among these animals: this is but the work of a day; the other is the great adventure of their lives. Indeed, this faculty of changing the skin is not peculiar to caterpillars only, but is common to all the insect kind; and even to some animals that claim a higher rank in nature. We have already seen the lobster and the crab outgrowing their first shells, and then bursting from their confinement, in order to assume a covering more roomy and convenient. It is probable that the louse, the flea, and the spider, change their covering from the same necessity; and growing too large for the crust in which they have been for some time enclosed, burst it for another. This period is probably that of their growth; for as soon as their new skin is hardened round them, the animal's growth is necessarily circumscribed while it remains within it. With respect to caterpillars, many of them change their skins five or six times in a season; and this covering, when cast off, often seems so complete, that many might mistake the empty skin for the real insect. Among the hairy caterpillars, for instance, the cast skin is covered with hair; the feet, as well gristly as membranous, remain fixed to it; even the parts which nothing but a microscope can discover, are visible in it; in short, all the parts of the head; not only the skull, but the teeth.

In proportion as the time approaches in which the caterpillar is to cast its old skin, its colours become more feeble, the skin seems to wither and grow dry, and in some measure resembles a leaf, when it is no longer supplied with moisture from the stock. At that time the insect begins to find itself under a necessity of changing; and it is not effected without violent labour, and perhaps pain. A day or two before the critical hour approaches, the insect ceases to eat, loses its usual activity, and seems to rest immoveable. It seeks some place to remain in security; and no longer timorous seems regardless even of the touch. It is now and then seen to bend itself and elevate its back: again it stretches to its utmost extent: it sometimes lifts up the head, and then lets it fall again; it sometimes waves it three or four times from side to side, and then remains in quiet. At length, some of the rings of its body, particularly the first and second, are seen to swell considerably, the old skin distends and bursts, till, by repeated swellings and contractions in every ring, the animal disengages itself, and creeps from its inconvenient covering.

How laborious soever this operation may be, it is performed in the space of a minute; and the animal, having thrown off its old skin, seems to enjoy new vigour, as well as acquired colouring and beauty. Sometimes it happens that it takes a new appearance, and colours very differ-

ent from the old. Those that are hairy still preserve their covering; although their ancient skin seems not to have lost a single hair; every hair appears to have been drawn like a sword from the scabbard. However, the fact is, that a new crop of hair grows between the old skin and the new, and probably helps to throw off the external covering.

The caterpillar having in this manner continued for several days feeding, and at intervals casting its skin, begins at last to prepare for its change into an aurelia. It is most probable that, from the beginning, all the parts of the butterfly lay hid in this insect, in its reptile state; but it required time to bring them to perfection; and a large quantity of food, to enable the animal to undergo all the changes requisite for throwing off these skins which seem to clog the butterfly form. However, when the caterpillar has fed sufficiently, and the parts of the future butterfly have formed themselves beneath its skin, it is then time for it to make its first great and principal change into an aurelia, or a chrysalis, as some have chosen to call it; during which, as was observed, it seems to remain for several days, or even months, without life or motion.

Preparatory to this important change, the caterpillar most usually quits the plant, or the tree on which it fed: or at least attaches itself to the stalk or the stem, more gladly than the leaves. It forsakes its food, and prepares, by fasting, to undergo its transmutation. In this period, all the food it has taken is thoroughly digested; and it often voids even the external membrane which lined its intestines.

Some of this tribe, at this period also, are seen entirely to change colour; and the vivacity of the tints, in all, seems faded. Those of them which are capable of spinning themselves a web, set about this operation; those which have already spun, await the change in the best manner they are able. The web or cone, with which some cover themselves, hides the aurelia contained within from the view; but in others, where it is more transparent, the caterpillar, when it has done spinning, strikes into it the claws of the two feet under the tail, and afterwards forces in the tail itself, by contracting those claws, and violently striking the feet one against the other. If, however, they be taken from their web at this time, they appear in a state of great languor; and, incapable of walking, remain on that spot where they are placed. In this condition they remain one or two days, preparing to change into an aurelia; somewhat in the manner they made preparations for changing their skin. They then appear with their bodies bent into a bow, which they now and then are seen to straighten: they make no use of their legs; but if they attempt to change place, do it by the contortions of their body. In proportion as their change into an aurelia approaches, their body becomes more and more bent; while their exten-

sions and convulsive contractions become more frequent. The hinder end of the body is the part which the animal first disengages from its caterpillar skin; that part of the skin remains empty, while the body is drawn up contractedly towards the head. In the same manner they disengage themselves from the two succeeding rings; so that the animal is then lodged entirely in the fore part of its caterpillar covering: that half which is abandoned, remains flaccid and empty; while the fore part on the contrary is swollen and distended. The animal, having thus quitted the hinder part of its skin, to drive itself up into the fore part, still continues to heave and work as before; so that the skull is soon seen to burst into three pieces, and a longitudinal opening is made in the three first rings of the body, through which the insect thrusts forth its naked body with strong efforts. Thus at last it entirely gets free from its caterpillar skin, and for ever forsakes its most odious reptile form.

The caterpillar, thus stripped of its skin for the last time, is now become an aurelia: in which the parts of the future butterfly are all visible; but in so soft a state, that the smallest touch can discompose them. The animal is now become helpless and motionless; but only waits for the assistance of the air to dry up the moisture on its surface, and supply it with a crust capable of resisting external injuries. Immediately after being stripped of its caterpillar skin, it is of a green colour, especially in those parts which are distended by an extraordinary afflux of animal moisture; but in ten or twelve hours after being thus exposed, its parts harden, the air forms its external covering in a firm crust, and in about four and twenty hours the aurelia may be handled, without endangering the little animal that is thus left in so defenceless a situation. Such is the history of the little pod or cone that is found so common by every pathway, sticking to nettles, and sometimes shining like polished gold. From the beautiful and resplendent colour, with which it is thus sometimes adorned, some authors have called it a *Chrysalis*, implying a creature made of gold.

Such are the efforts by which these little animals prepare for a state of perfection; but their care is still greater to provide themselves a secure retreat, during this season of their imbecility. It would seem like erecting themselves a monument, where they were to rest secure, until Nature had called them into a new and more improved existence. For this purpose, some spin themselves a cone or web, in which they lie secure till they have arrived at maturity: others, that cannot spin so copious a covering, suspend themselves by the tail, in some retreat where they are not likely to meet disturbances. Some mix sand with their gummy and moist webs, and thus make themselves a secure incrustation; while others, before their change, bury themselves in the ground, and thus avoid the numer-

ous dangers that might attend them. One would imagine that they were conscious of the precise time of their continuance in their aurelia state; since their little sepulchres, with respect to the solidity of the building, are proportioned to such duration. Those that are to lie in that state of existence but a few days, make choice of some tender leaf, which they render still more pliant by diffusing a kind of glue upon it: the leaf thus gradually curls up, and withering as it enfolds, the insect wraps itself within, as in a mantle, till the genial warmth of the sun enables it to struggle for new life, and burst from its confinement. Others, whose time of transformation is also near at hand, fasten their tails to a tree, or to the first worm-hole they meet in a beam, and wait in that defenceless situation. Such caterpillars, on the other hand, as are seen to lie several months in their aurelia state, act with much greater circumspection. Most of them mix their web with sand, and thus make themselves a strong covering: others build in wood, which serves them in the nature of a coffin. Such as have made the leaves of willows their favourite food, break the tender twigs of them first into small pieces, then pound them as it were to powder; and, by means of their glutinous silk, make a kind of paste, in which they wrap themselves up. Many are the forms which these animals assume in this helpless state; and it often happens, that the most deformed butterflies issue from the most beautiful aurelias.

In general, however, the aurelia takes the rude outline of the parts of the animal which is contained within it; but as to the various colours which it is seen to assume, they are rather the effect of accident; for the same species of insect does not at all times assume the same hue, when it becomes an aurelia. In some, the beautiful gold colour is at one time found; in others it is wanting. This brilliant hue, which does not fall short of the best gilding, is formed in the same manner in which we see leather obtain a gold colour, though none of that metal ever enters into the tincture. It is only formed by a beautiful brown varnish, laid upon a white ground; and the white thus gleaming through the transparency of the brown, gives a charming golden yellow. These two colours are found, one over the other, in the aurelia of the little animal we are describing; and the whole appears gilded without any real gilding.

The aurelia thus formed, and left to time to expand into a butterfly, in some measure resembles an animal in an egg, that is to wait for external warmth to hatch it into life and vigour. As the quantity of moisture, that is enclosed within the covering of the aurelia, continues to keep its body in the most tender state, so it is requisite that this humidity should be dried away, before the little butterfly can burst its prison. Many have been the experiments to prove that nature may in this respect be assisted

by art; and that the life of the insect may be retarded or quickened, without doing it the smallest injury. For this purpose, it is only requisite to continue the insect in its aurelia state, by preventing the evaporation of its humidity; which will consequently add some days, nay weeks, to its life: on the other hand, by evaporating its moisture in a warm situation, the animal assumes its winged state before its usual time, and goes through the offices assigned its existence. To prove this, Mr. Reaumur enclosed the aurelia in a glass tube; and found the evaporated water, which exhaled from the body of the insect, collected in drops at the bottom of the tube: he covered the aurelia with varnish; and this making the evaporation more difficult and slow, the butterfly was two months longer than its natural term, in coming out of its case: he found, on the other hand, that by laying the animal in a warm room, he hastened the disclosure of the butterfly; and by keeping it in an ice-house, in the same manner he delayed it. Warmth acted, in this case, in a double capacity; invigorating the animal, and evaporating the moisture.

The aurelia, though it bears a different external appearance, nevertheless contains within it all the parts of the butterfly in perfect formation; and lying each in a very orderly manner, though in the smallest compass. These, however, are so fast and tender, that it is impossible to visit without discomposing them. When either by warmth, or increasing vigour, the parts have acquired the necessary force and solidity, the butterfly then seeks to disembarass itself of those bands which kept it so long in confinement. Some insects continue under the form of an aurelia not above ten days; some twenty; some several months, and even for a year together.

The butterfly, however, does not continue so long under the form of an aurelia as one would be apt to imagine. In general those caterpillars that provide themselves with cones, continue within them but a few days after the cone is completely finished. Some, however, remain buried in this artificial covering for eight or nine months, without taking the smallest sustenance during the whole time: and though in the caterpillar state no animals were so voracious, when thus transformed they appear a miracle of abstinence. In all, sooner or later, the butterfly bursts from its prison; not only that natural prison which is formed by the skin of the aurelia, but also from that artificial one of silk, or any other substance in which it has enclosed itself.

The efforts which the butterfly makes to get free from its aurelia state, are by no means so violent as those which the insect had in changing from the caterpillar into the aurelia. The quantity of moisture surrounding the butterfly is by no means so great as that attending its

former change; and the shell of the aurelia is so dry, that it may be cracked between the fingers.

If the animal be shut up within a cone, the butterfly always gets rid of the natural internal skin of the aurelia, before it eats its way through the external covering which its own industry has formed round it. In order to observe the manner in which it thus gets rid of the aurelia covering, we must cut open the cone, and then we shall have an opportunity of discovering the insect's efforts to emancipate itself from its natural shell. When this operation begins, there seems to be a violent agitation in the humours contained within the little animal's body. Its fluids seem driven, by a hasty fermentation, through all the vessels; while it labours violently with its legs, and makes several other violent struggles to get free. As all these motions concur with the growth of the insect's wings and body, it is impossible that the brittle skin which covers it should longer resist: it at length gives way, by bursting into four distinct and regular pieces. The skin of the head and legs first separates; then the skin at the back flies open, and dividing into two regular portions, disengages the back and wings: then there likewise happens another rupture, in that portion which covered the rings of the back of the aurelia. After this the butterfly, as if fatigued with its struggles, remains very quiet for some time, with its wings pointed downwards, and its legs fixed in the skin which it had just thrown off. At first sight the animal, just set free, and permitted the future use of its wings, seems to want them entirely; they take up such little room, that one would wonder where they were hidden. But soon after they expand so rapidly, that the eye can scarce attend their unfolding. From reaching scarce half the length of the body, they acquire, in a most wonderful manner, their full extent and bigness, so as to be each five times larger than they were before. Nor is it the wings alone that are thus increased; all their spots and paintings, before so minute as to be scarce discernible, are proportionably extended; so that what a few minutes before seemed only a number of confused unmeaning points, now become distinct and most beautiful ornaments. Nor are the wings, when thus expanded, unfolded in the manner in which earwigs and grasshoppers display theirs, who unfurl them like a lady's fan: on the contrary, those of butterflies actually grow to their natural size in this very short space. The wing, at the instant it is freed from its late confinement, is considerably thicker than afterwards; so that it spreads in all its dimensions, growing thinner as it becomes broader. If one of the wings be plucked from the animal just set free, it may be spread by the fingers, and it will soon become as broad as the other which has been left behind. As the wings extend themselves so suddenly, they have not yet had time to dry; and accordingly appear like

pieces of wet paper, soft and full of wrinkles. In about half an hour they are perfectly dry, their wrinkles entirely disappear, and the little animal assumes all its splendour. The transmutation being thus perfectly finished, the butterfly discharges three or four drops of a blood-coloured liquid, which are the last remains of its superfluous moisture.¹ Those aurelias which are enclosed within a cone, find their exit more difficult, as they have still another prison to break through: this, however, they perform in a short time; for the butterfly, freed from its aurelia skin, butts with its head violently against the walls of its artificial prison; and probably with its eyes, that are rough and like a file, it rubs the internal surface away; till it is at last seen bursting its way into open light; and in less than a quarter of an hour, the animal acquires its full perfection.

Thus, to use the words of Swammerdam, we see a little insignificant creature distinguished, in its last birth, with qualifications and ornaments, which man, during his stay upon earth, can never even hope to acquire. The butterfly, to enjoy life, needs no other food but the dews of heaven, and the honeyed juices which are distilled from every flower. The pageantry of princes cannot equal the ornaments with which it is invested; nor the rich colouring that embellishes its wings. The skies are the butterfly's proper habitation, and the air is its element: whilst man comes into the world naked, and often roves about without habitation or shelter; exposed on the one hand to the heat of the sun, and on the other to the damps and exhalations of the earth; both alike enemies of his happiness and existence. A strong proof that, while this little animal is raised to its greatest height, we are as yet in this world only candidates for perfection!

CHAP. III.

OF BUTTERFLIES AND MOTHS.

It has been already shown, that all butterflies are bred from caterpillars; and we have exhibited the various circumstances of that surprising change. It has been remarked, that butter-

¹ These red drops, which several of the butterfly tribe discharge immediately upon their transformation, have been recorded by ancient writers, as showers of blood, portending some convulsion of nature, or national calamity. In the year 1608, the inhabitants of the town of Aix were in the utmost consternation, in consequence of a discharge of this kind, which fell in the suburbs, and for some miles round. But the philosopher Pieresc soon quieted their alarms, by showing them that the whole of this wonder originated in a flight of harmless butterflies, that had just taken wing from their chrysalis state.—Ed.

flies may be easily distinguished from flies of every other kind, by their wings: for, in others, they are either transparent like gauze, as we see in the common flesh-fly; or they are hard and crusted, as we see in the wings of the beetle. But in the butterfly, the wings are soft, opaque, and painted over with a beautiful dust, that comes off with handling.

The number of these beautiful animals is very great; and though Linnaeus has reckoned up above seven hundred and sixty different kinds, the catalogue is still very incomplete. Every collector of butterflies can show undescribed species: and such as are fond of minute discovery can here produce animals that have been examined only by himself. In general, however, those of the warm climates are larger and more beautiful than such as are bred at home; and we can easily admit the beauty of the butterfly, since we are thus freed from the damage of the caterpillar. It has been the amusement of some to collect these animals from different parts of the world; or to breed them from caterpillars at home. These they arrange in systematic order, or dispose so as to make striking and agreeable pictures; and all must grant, that this specious idleness is far preferable to that unhappy state which is produced by a total want of employment.

The wings of butterflies, as was observed, fully distinguish them from flies of every other kind. They are four in number; and though two of them be cut off, the animal can fly with the two others remaining. They are, in their own substance, transparent; but owe their opacity to the beautiful dust with which they are covered; and which has been likened, by some naturalists, to the feathers of birds; by others, to the scales of fishes; as their imaginations were disposed to catch the resemblance. In fact, if we regard the wing of a butterfly with a good microscope, we shall perceive it studded over with a variety of little grains of different dimensions and forms, generally supported upon a footstalk, regularly laid upon the whole surface. Nothing can exceed the beautiful and regular arrangement of these little substances; which thus serve to paint the butterfly's wing, like the tiles of a house. Those of one rank are a little covered by those that follow: they are of many figures; on one part of the wing may be seen a succession of oval studs; on another part, a cluster of studs, each in the form of a heart: in one place they resemble a hand open; and in another they are long or triangular; while all are interspersed with taller studs, that grow between the rest, like mushrooms upon a stalk. The wing itself is composed of several thick nerves, which render the construction very strong, though light; and though it be covered over with thousands of these scales or studs, yet its weight is very little increased by the number. The animal is with ease enabled to support itself a long while in air, although its flight be not very graceful. When

it designs to fly to a considerable distance, it ascends and descends alternately; going sometimes to the right and sometimes to the left, without any apparent reason. Upon closer examination, however, it will be found that it flies thus irregularly in pursuit of its mate; and as dogs bait and quarter the ground in pursuit of their game, so these insects traverse the air in quest of their mates, whom they can discover at more than a mile's distance.

If we prosecute our description of the butterfly, the animal may be divided into three parts; the head, the corslet, and the body.

The body is the hinder part of the butterfly, and is composed of rings, which are generally concealed under long hair, with which that part of the animal is clothed. The corslet is more solid than the rest of the body, because the forewings and the legs are fixed therein. The legs are six in number, although four only are made use of by the animal; the two forelegs being often so much concealed in the long hair of the body, that it is sometimes difficult to discover them. If we examine these parts internally, we shall find the same set of vessels in the butterfly that we observed in the caterpillar; but with this great difference, that as the blood or humours in the caterpillar circulated from the tail to the head, they are found in the butterfly to take a direct contrary course, and to circulate from the head to the tail; so that the caterpillar may be considered as the embryo animal, in which, as we have formerly seen, the circulation is carried on differently from what it is in animals when excluded.

But leaving the other parts of the butterfly, let us turn our attention particularly to the head. The eyes of butterflies have not all the same form; for in some they are large, in others small; in some they are the larger portion of a sphere, in others they are but a small part of it, and just appearing from the head. In all of them, however, the outward coat has a lustre, in which may be discovered the various colours of the rainbow. When examined a little closely, it will be found to have the appearance of a multiplying-glass; having a great number of sides or facets, in the manner of a brilliant cut diamond. In this particular the eye of the butterfly, and of most other insects, entirely correspond; and Leuwenhoek pretends there are above six thousand facets on the cornea of the flea. These animals, therefore, see not only with great clearness, but view every object multiplied in a surprising manner. Puget adapted the cornea of a fly in such a position as to see objects through it by the means of a microscope; and nothing could exceed the strangeness of its representation. A soldier, who was seen through it, appeared like an army of pigmies; for while it multiplied, it also diminished the object; the arch of a bridge exhibited a spectacle more magnificent than human skill could perform; the flame of a candle

seemed a beautiful illumination. It still, however, remains a doubt, whether the insect sees objects singly, as with one eye; or whether every facet is itself a complete eye, exhibiting its own object distinct from all the rest.

Butterflies, as well as most other flying insects, have two instruments, like horns, on their heads, which are commonly called feelers. They differ from the horns of greater animals, in being moveable at their base; and in having a great number of joints, by which means the insect is enabled to turn them in every direction. Those of butterflies are placed at the top of the head, pretty near the external edge of each eye. What the use of these instruments may be, which are thus formed with so much art, and by a WORKMAN who does nothing without reason, is as yet unknown to man. They may serve to guard the eye; they may be of use to clean it; or they may be the organ of some sense which we are ignorant of: but this is only explaining one difficulty by another. We are not so ignorant of the uses of the trunk, which few insects of the butterfly kind are without. This instrument is placed exactly between the eyes; and when the animal is not employed in seeking its nourishment, it is rolled up like a curl. A butterfly, when it is feeding, flies round some flower, and settles upon it. The trunk is then uncurled, and thrust out either wholly or in part; and is employed in searching the flower to its very bottom, let it be ever so deep. This search being repeated seven or eight times, the butterfly then passes to another; and continues to hover over those agreeable to its taste, like a bird over its prey. This trunk consists of two equal hollow tubes, nicely joined to each other, like the pipes of an organ.

Such is the figure and conformation of these beautiful insects, that cheer our walks, and give us the earliest intimations of summer. But it is not by day alone that they are seen fluttering wantonly from flower to flower, as the greatest number of them fly by night, and expand the most beautiful colouring at those hours when there is no spectator. This tribe of insects has, therefore, been divided into Diurnal and Nocturnal Flies; or, more properly speaking, into Butterflies and Moths: the one flying only by day, the other most usually on the wing in the night. They may be easily distinguished from each other by their horns or feelers: those of the butterfly being clubbed or knobbed at the end; those of the moth tapering finer and finer to a point. To express it technically—the feelers of butterflies are clavated; those of moths are filiform.¹

¹ "There are at least five different species of moths similar in manners and economy, the caterpillars of which feed upon animal substances, such as furs, woollen cloths, silk, leather, and, what to the naturalist is no less vexing, upon the specimens of insects and other animals preserved in his cabinet.

The butterflies, as well as the moths, employ the short life assigned them in a variety of enjoyments. Their whole time is spent either in quest of food, which every flower offers; or in pursuit of the female, whose approach they can often perceive at above two miles' distance. Their sagacity in this particular is not less astonishing than true; but by what sense they are thus capable of distinguishing each other at such distances is not easy to conceive. It cannot be by the sight, since such small objects as they are, must be utterly imperceptible at half the distance

at which they perceive each other: it can scarcely be by the sense of smelling, since the animal has no organs for that purpose. Whatever be their powers of perception, certain it is that the male, after having fluttered, as if carelessly about for some time, is seen to take wing, and go forward, sometimes for two miles together, in a direct line, to where the female is perched on a flower.

The general rule among insects is, that the female is larger than the male; and this obtains particularly in the tribe I am describing. The body of the male is smaller and slenderer; that of the female more thick and oval. Previous to the junction of these animals, they are seen sporting in the air, pursuing and flying from each other, and preparing, by a mock combat, for the more important business of their lives. If they be disturbed while united, the female flies off with the male on her back, who seems entirely passive upon the occasion.

But the females of many moths and butterflies seem to have assumed their airy form for no other reason but to fecundate their eggs, and lay them. They are not seen fluttering about in quest of food or a mate: all that passes during their short lives, is a junction with the male of about half an hour; after which they deposit their eggs and die, without taking any nourishment or seeking any. It may be observed, however, that in all the females of this tribe, they are impregnated by the male by one aperture, and lay their eggs by another.

The eggs of female butterflies are disposed in the body like a bed of chaplets; which, when excluded, are usually oval, and of a whitish colour: some, however, are quite round; and others flatted like a turnip. The covering, or shell of the egg, though solid, is thin and transparent; and in proportion as the caterpillar grows within the egg, the colours change, and are distributed differently. The butterfly seems very well instructed by nature in its choice of the plant, or the leaf, where it shall deposit its burthen. Each egg contains but one caterpillar; and it is requisite that this little animal, when excluded, should be near its peculiar provision. The butterfly, therefore, is careful to place her brood only upon those plants that afford good nourishment to its posterity. Though the little winged animal has been fed itself upon dew, or the honey of flowers, yet it makes choice for its young of a very different provision, and lays its eggs on the most unsavoury plants; the rag-weed, the cabbage, or the nettle. Thus every butterfly chooses not the plant most grateful to it in its winged state; but such as it has fed upon in its reptile form.

All the eggs of butterflies are attached to the leaves of the favourite plant, by a sort of size or glue; where they continue unobserved, unless carefully sought after. The eggs are sometimes placed round the tender shoots of plants, in the

The moths in question are of the family named *Tinea* by Entomologists, such as the tapestry moth, the fur moth, the wool moth, the cabinet moth, &c.

"The moths themselves are, in the winged state, small, and well fitted for making their way through the most minute hole or chink, so that it is scarcely possible to exclude them by the closeness of a wardrobe or a cabinet. If they cannot effect an entrance when a drawer is out, or a door open, they will contrive to glide through the key-hole; and if they once get in, it is no easy matter to dislodge or destroy them, for they are exceedingly agile, and escape out of sight in a moment. Mousset is of opinion that the ancients possessed an effectual method of preserving stuffs from the moth, because the robes of Servius Tullius were preserved up to the death of Sejanus, a period of more than five hundred years. On turning to Pliny to learn this secret, we find him relating that stuff laid upon a coffin will be ever after safe from moths; in the same way as a person once stung by a scorpion will never afterwards be stung by a bee, or a wasp, or a hornet! Rhasis again says, that cantharides suspended in a house drive away moths, and he adds, that they will not touch any thing wrapped in a lion's skin!—the poor little insects, says Reaumur sarcastically, being probably in bodily fear of so terrible an animal. Such are the stories which fill the imagination even of philosophers, till real science entirely expels them. The effluvia of camphor or turpentine may sometimes kill them, when in the winged state, but this will have no effect upon their eggs, and seldom upon the caterpillars; for they wrap themselves up too closely to be easily reached by any agent except heat. This, when it can be conveniently applied, will be certain either to dislodge or to kill them. When the effluvia of turpentine, however, reaches the caterpillar, Bonnet says it falls into convulsions, becomes covered with livid blotches, and dies.

"The mother-insect takes care to deposit her eggs on or near such substances as she instinctively foreknows will be best adapted for the food of the young, taking care to distribute them so that there may be a plentiful supply and enough of room for each. We have found, for example, some of those caterpillars feeding upon the shreds of cloth used in training wall-fruit trees; but we never saw more than two caterpillars on one shred. This scattering of the eggs in many places, renders the effects of the caterpillars more injurious, from their attacking many parts of a garment or a piece of stuff at the same time. When one of the caterpillars of this family issues from the egg, its first care is to provide itself with a domicile, which indeed seems no less indispensable to it than food; for, like all caterpillars that feed under cover, it will not eat while it remains unprotected. Its mode of building is very similar to that which is employed by other caterpillars that make use of extraneous materials. The foundation or frame-work is made of silk secreted by itself, and into this it interweaves portions of the material upon which it feeds."—*Insect Architecture*.

form of bracelets, consisting of above two hundred in each, and generally surrounding the shoot like a ring upon a finger. Some butterflies secure their eggs from the injuries of air, by covering them with hair plucked from their own bodies, as birds sometimes are seen to make their nests; so that their eggs are thus kept warm, and also entirely concealed.

All the tribe of female moths lay their eggs a short time after they leave the aurelia; but there are many butterflies that flutter about the whole summer, and do not think of laying till the winter begins to warn them of their approaching end; some even continue the whole winter in the hollows of trees, and do not provide for posterity until the beginning of April, when they leave their retreats, deposit their eggs, and die. Their eggs soon begin to feel the genial influence of the season: the little animals burst from them in their caterpillar state, to become aurelias and butterflies in their turn, and thus to continue the round of nature.

SUPPLEMENTARY NOTE.

So far as a general view of caterpillars, with their butterflies and moths, goes, Goldsmith will be found to be very complete; and it would be impossible to enter into any survey of the individual species of this tribe of insects without extending the notes beyond all reasonable bounds. Room, however, may be spared for a few of the more remarkable butterflies belonging to this country.

The *Large White butterfly* is a common species; and often, in its caterpillar state, very destructive to cabbage and cauliflower plants. The caterpillars seem almost confined to these vegetables, on which they are generally to be found in great numbers from June to October. The general colour of these butterflies is white, but the male differs from the female in having a few dark spots on its wings. They first appear on wing in the middle of May, and about the end of the same month lay their eggs in clusters on the under side of cabbage leaves. In a few days after the caterpillars come forth, and continue to feed together till the end of June, when they are at their full growth. They then traverse about in search of convenient places to fix themselves, where, after their change, the chrysalis may be sheltered. When such are found, they each fasten their tail by a web, and carry a strong thread of the same round their body, near the head; and, thus firmly secured, hang a few hours, when the chrysalis becomes perfectly formed, and divested of the caterpillar's skin. In fourteen days after this the fly is on the wing. The caterpillars of this latter brood arrive at full growth, and change to chrysalides in September, in which state they remain through the winter till the beginning of the following May. During this time we often see them hanging under the copings of garden walls, under pales, and in other places where they can have a tolerable shelter from the inclemency of the weather.

The *Marsh-fritillary* is a small butterfly, not more than an inch and a half across the broadest part of its expanded wings. Its colour is a brownish orange, variegated with yellow and black, in a small pattern. The under sides of the wings are lighter, and chiefly orange and yellow. From these under sides having always a greasy appearance, it is sometimes called the greasy, or dish-clout fritillary. In September the caterpillars may be seen in great abundance.

II.

They keep together under the cover of a fine web, which they spin to defend themselves from the inclemency of the weather; and in the protection of this they pass the winter months. During this time they are so nearly reduced to a torpid state as to require no food, nor do they venture out of their general covering till invited by the warmth of the spring. As they afterwards increase in size they spread abroad in search of food; but their local attachment is very remarkable, for neither the caterpillar, nor even the butterfly, will stray far from the place where it was bred. Numbers of the latter may sometimes be observed on wing in a small spot of swampy or marsh land, when not one of them is to be met with in any of the adjacent places. As they fly very low, and frequently settle, they are easily caught. The caterpillars are generally at their full growth about the last week in April: when this takes place, they suspend themselves by the tail to change into chrysalides, in which state they remain fourteen days. Their mode of suspension is a singular instance of the extraordinary power of instinct. They first draw two or three small blades of grass across towards their top, and fasten them together by means of their silk; then hang themselves beneath the centre of these, each having his own little canopy. By this means they are not only hidden from the sight of birds, but defended in a great measure from the damage they might otherwise sustain from windy and boisterous weather. They feed on the devils-bit, scabious, and on various kinds of the marsh grasses; eating only the opening leaves as they come up, which renders them sometimes difficult to find: this they do also only while the sun shines; for if in the very act the sun becomes hidden behind a cloud, they immediately cease, but on the return of the sun-beams they recommence their operations with great voracity.

The *Peacock butterfly* has angular and indented wings, of a brownish red colour, with black spots. There is a large blue eye-like spot on each; and on each of the upper wings there are two black spots. The caterpillars of this butterfly are produced from eggs which have been deposited in the spring of the year on the nettle. They live in society, and are to be found through the early part of the summer, feeding on this plant. They are black, and their bodies are covered with spines, and marked with numerous small white specks. Shortly after the little animals see the light, they begin to spin for themselves a large and commodious web, into which they flee for shelter during rainy weather, and in the night; and under the protection of which they change their skins. When they have attained their full growth, they seek out some place where they can safely take the chrysalid form. In doing this, they suspend themselves vertically, with the head downward; and the chrysalis, thus suspended, continues for about twenty days. About the end of this time the animal becomes perfected, breaks from its shell, and flies away. In the south of England the peacock butterfly is sufficiently common; but it is extremely rare in the north. In the county of York, it is not known to have been more than twice caught. During the winter it conceals itself, and does not die until after it has deposited its eggs in the ensuing spring.

The *Purple Emperor* has indented wings, of a rich brown colour, with a blue gloss, and a whitish interrupted band on each side. On the upper part of the under wings there is an eye-like spot. This is the most beautiful and most interesting of all the British butterflies. In his manners, as well as in the varying lustre of his purple plumes, says Mr. Haworth, he possesses the strongest claims to our attention. It is in the month of July that he makes his appearance in the winged state; and he invariably

fixes his throne upon the summit of some lofty oak, from the utmost sprigs of which, in sunny days, he performs his aerial excursions. "In these," continues this writer, "he ascends to a greater elevation than any insect I have ever seen, sometimes mounting even higher than the eye can follow, especially if he happen to quarrel with another emperor, the monarch of some neighbouring oak. These insects never meet without a battle, flying upward all the while, and combating furiously with each other: after which they frequently return to the identical sprigs from which they each ascended. The purple emperor commences his aerial movements from ten till twelve o'clock in the morning, but does not perform his loftiest flights till noon; decreasing them after this hour, until he ceases to fly about four in the afternoon." The females, like those of many other species, are rarely seen on wing, the reason of which is not only interesting, but is little known. It is their being destitute of a certain *spiral socket*, which the males possess, near the base of the main tendon of the upper wings. This socket receives and works a strong elastic *spring*, arising from the base of the under wings; whereby enabling to perform a stronger, longer, and more easy flight, than it is possible for the females to do. The males, as before stated, usually fly very high, and are only to be caught by means of a bag net fixed to the end of a rod twenty or thirty feet long. There have been instances, though they are rare, of their sitting on the ground near puddles of water, and being taken there. When the purple emperor is within reach, no insect is more easily caught: for he is so bold and fearless, that he will not move from his settling place until he is quite pushed off. The caterpillar is green, with oblique white lines. It is rough on the upper part of the body; and on the head there are two spines. It feeds on the oak. The chrysalis is green, has two horns, and is somewhat compressed.

The upper wings of the *Nettle tortoise-shell butterfly*, which is one of the most beautiful and common of the British butterflies, are red, and marked with alternate bands of black and pale orange; below these are three black spots, the inner one of which is square; and near the extremity of their upper parts is a white stripe. The lower wings are also red, marked with a large black patch at the base.

The whole of the butterfly tribe undergo four changes in passing from the egg to the perfect insect or butterfly. These metamorphoses seem to have been known to the ancient Greeks, and most probably suggested to them their principles of metempsychosis. Nothing could appear to them more confirmatory of the doctrine than that an inert aurelia should be again transformed into a living body. The only method which they had for explaining this phenomenon was, that it had been tenanted by the soul of some wretch, whose misdeeds on earth had merited such a pilgrimage.

Butterflies are strictly oviparous animals, and the female, by an unerring foresight, uniformly deposits her eggs in the place where food is to be found for the future caterpillar after its exclusion from the egg.

The eggs are usually enveloped in an adhesive cement, by which they are attached to the spot where they are deposited. This wise provision is designed to prevent the eggs from being removed to a situation where the proper food of the species might not be found, and where the caterpillar would consequently die of hunger.

The eggs of butterflies are of many different shapes, and hardly two species produce them alike. When the eggs have remained their proper time, the caterpillar, or larva, bursts from its confinement. At first it is exceedingly small, but increases daily, until it reaches its full size. The great proportional

bulk at which many caterpillars arrive, in comparison to their original size when they emerge from the shell, is surprising. The larva of the Goat moth (*Cossus ligniperda*), on attaining its full magnitude, is seventy-two thousand times heavier than when it first bursts into life; and the maggot of the Blue fly is, in twenty-four hours, one hundred and fifty-five times heavier than at its birth. Many caterpillars consume more than twice their own bulk of food every twenty-four hours. The cause assigned for this is, that their stomachs have not the power of dissolving vegetable matter, but merely the faculty of extracting their juices. When the larva has attained its full size, it soon afterwards ceases to eat, becomes excessively restless, and searches for a place fitted to its nature, to which it may retire, for the purpose of being transformed from one state of existence to another, and of assuming its pupa condition. Some spin for themselves a covering of silky filaments, while others simply attach themselves to the under side of a leaf or branch. After remaining for some months in this state, the concealed animal bursts its casement, and emerges as the perfect butterfly; in which condition it exists only for a very limited period; and, after having provided for the continuance of its race, speedily dies.

The transformation of insects, however, consists rather in a series of developments than in any absolute metamorphosis, being only a transition of changes in organs which lie concealed from human view. The caterpillar is compound in its nature, with the germs of the perfect insect hidden in a succession of cases. The first is the covering of the pupa, which is concealed within three or four mantles, the one over the other: these will, in succession, enrobe the larva; and as it enlarges the parts become visible, and are alternately thrown off, until the perfect insect bursts from its confinement.

It is certainly wonderful that the simple caterpillar, when it first emerges from the egg, not thicker than a thread of silk, should contain its own covering threefold, and, in some instances, even eightfold, with the mask of a pupa and a butterfly, folded in the most astonishing manner over each other; and besides these, should possess different respiratory and digestive organs, a nervous system, and muscles of motion peculiar to every successive stage of its existence. And, what is truly wonderful, the stomach in its caterpillar state is fitted for the reception of vegetable food, while in the perfect condition of the butterfly it is incapable of digesting ordinary vegetables, and is only fitted for containing honey, which the animal sips from flowers by means of a proboscis.

CHAP. IV.

OF THE ENEMIES OF THE CATERPILLAR.

NATURE, though it has rendered some animals surprisingly fruitful, yet ever takes care to prevent their too great increase. One set of creatures is generally opposed to another: and those are chiefly the most prolific that are, from their imbecility, incapable of making any effectual defence. The caterpillar has, perhaps, of all other animals, the greatest number of enemies; and seems only to exist by its surprising fecundity. Some animals devour them by hundreds; others more minute, yet more dangerous, mangle them

in various ways: so that, how great soever their numbers may be, their destroyers are in equal proportion. Indeed, if we consider the mischiefs these reptiles are capable of occasioning, and the various damages we sustain from their insatiable rapacity, it is happy for the other ranks of nature, that there are thousands of fishes, birds, and even insects, that live chiefly upon caterpillars, and make them their most favourite repast.

When we described the little birds that live in our gardens, and near our houses, as destructive neighbours, sufficient attention was not paid to the services which they are frequently found to render us. It has been proved, that a single sparrow and its mate, that have young ones, destroy above three thousand caterpillars in a week; not to mention several butterflies in which numberless caterpillars are destroyed in embryo. It is in pursuit of these reptiles that we are favoured with the visits of many of our most beautiful songsters, that amuse us during their continuance, and leave us when the caterpillars disappear.

The maxim which has often been urged against man, that he, of all other animals, is the only creature that is an enemy to his own kind, and that the human species only are found to destroy each other, has been adopted by persons who never considered the history of insects. Some of the caterpillar kind, in particular, that seem fitted only to live upon leaves and plants, will, however, eat each other; and the strongest will devour the weak in preference to their vegetable food. That which lives upon the oak is found to seize any of its companions, which it conveniently can, by the first rings, and inflict a deadly wound: it then feasts in tranquillity on its prey, and leaves nothing of the animal but the husk.

But it is not from each other they have the most to fear, as in general they are inoffensive; and many of this tribe are found to live in a kind of society. Many kinds of flies lay their eggs either upon or within their bodies; and, as these turn into worms, the caterpillar is seen to nourish a set of intestine enemies within its body, that must shortly be its destruction: Nature having taught flies, as well as all other animals, the surest methods of perpetuating their kind.—“Towards the end of August,” says Reaumur, “I perceived a little fly, of a beautiful gold colour, busily employed in the body of a large caterpillar, of that kind which feeds upon cabbage. I gently separated that part of the leaf on which these insects were placed, from the rest of the plant, and placed it where I might observe them more at ease. The fly, wholly taken up by the business in which it was employed, walked along the caterpillar’s body, now and then remaining fixed to a particular spot. Upon this occasion I perceived it every now and then dart a sting, which it carried at the end of its tail, into the caterpillar’s body, and then drew it out again, to repeat the same operation in another place.

It was not difficult for me to conjecture the business which engaged this animal so earnestly; its whole aim was to deposit its eggs in the caterpillar’s body; which was to serve as a proper retreat to bring them to perfection. The reptile thus rudely treated, seemed to bear all very patiently, only moving a little when stung too deeply; which, however, the fly seemed entirely to disregard. I took particular care to feed this caterpillar; which seemed to me to continue as voracious and vigorous as any of the rest of its kind. In about ten or twelve days, it changed into an aurelia, which seemed gradually to decline, and died: upon examining its internal parts, the animal was entirely devoured by worms, which, however, did not come to perfection, as it is probable they had not enough to sustain them within.”

What the French philosopher perceived upon this occasion is every day to be seen in several of the larger kinds of caterpillars, whose bodies serve as a nest to various flies, that very carefully deposit their eggs within them. The large cabbage caterpillar is so subject to its injuries, that at certain seasons it is much easier to find them with than without them. The ichneumon fly, as it is called, particularly infests these reptiles, and prevents their fecundity. This fly is of all others the most formidable to insects of various kinds. The spider, that destroys the ant, the moth, and the butterfly, yet often falls a prey to the ichneumon; who pursues the robber to his retreat, and despising his nets, tears him in pieces, in the very labyrinth he has made. This insect, as redoubtable as the little quadruped that destroys the crocodile, has received the same name; and from its destruction of the caterpillar tribe, is probably more serviceable to mankind. This insect, I say, makes the body of the caterpillar the place for depositing its eggs, to the number of ten, fifteen, or twenty. As they are laid in those parts which are not mortal, the reptile still continues to live and to feed, showing no signs of being incommoded by its new guests. The caterpillar changes its skin, and sometimes undergoes the great change into an aurelia: but still the fatal intruders work within, and secretly devour its internal substance: soon after they are seen bursting through its skin, and moving away, in order to spin themselves a covering, previous to their own little transformation. It is indeed astonishing sometimes to see the number of worms, and those pretty large, that thus issue from the body of a single caterpillar and eat their way through its skin: but it is more extraordinary still that they should remain within the body, devouring its entrails, without destroying its life. The truth is, they seem instructed by nature not to devour its vital parts; for they are found to feed only upon that fatty substance which composes the largest part of the caterpillar’s body. When this surprising appearance was first observed, it was

supposed that the animal thus gave birth to a number of flies different from itself; and that the same caterpillar sometimes bred an ichneumon, and sometimes a butterfly: but it was not till after more careful inspection it was discovered, that the ichneumon tribe were not the caterpillar's offspring, but its murderers.

CHAP. V.

OF THE SILKWORM.

HAVING mentioned, in the last chapter, the damages inflicted by the caterpillar tribe, we now come to an animal of this kind, that alone compensates for all the mischief occasioned by the rest. This little creature, which only works for itself, has been made of the utmost service to man; and furnishes him with a covering more beautiful than any other animal can supply. We may declaim indeed against the luxuries of the times, when silk is so generally worn; but were such garments to fail, what other arts could supply the deficiency?

Though silk was anciently brought in small quantities to Rome, yet it was so scarce as to be sold for its weight in gold; and was considered as such a luxurious refinement in dress, that it was infamous for a man to appear in habits of which silk formed but half the composition. It was most probably brought among them from the remotest parts of the East; since it was, at the time of which I am speaking, scarcely known even in Persia.

Nothing can be more remote from the truth, than the manner in which their historians describe the animal by which silk is produced. Pausanias informs us, that silk came from the country of the Seres, a people of Asiatic Scythia; in which place an insect as large as the beetle, but in every other respect resembling a spider, was bred up for that purpose. They take great care, as he assures us, to feed and defend it from the weather; as well during the summer's heat as the rigours of winter. This insect, he observes, makes its web with its feet, of which it has eight in number. It is fed for the space of four years upon a kind of paste, prepared for it; and at the beginning of the fifth, it is supplied with the leaves of the green willow, of which it is particularly fond. It then feeds till it bursts with fat; after which they take out its bowels, which are spun into the beautiful manufacture so scarce and costly.

The real history of this animal was unknown among the Romans till the time of Justinian; and it is supposed, that silkworms were not brought into Europe till the beginning of the twelfth century; when Roger, of Sicily, brought workmen in this manufacture from Asia Minor, after his return from his expedition to the Holy

Land, and settled them in Sicily and Calabria. From these the other kingdoms of Europe learned this manufacture; and it is now one of the most lucrative carried on among the southern provinces of Europe.

The silkworm is now very well known to be a large caterpillar, of a whitish colour, with twelve feet, and producing a butterfly of the moth kind. The cone on which it spins, is formed for covering it while it continues in the aurelia state; and several of these, properly wound off, and united together, form those strong and beautiful threads which are woven into silk. The feeding these worms, the gathering, the winding, the twisting, and the weaving their silk, is one of the principal manufactures of Europe; and as our luxuries increase, seems every day to become more and more necessary to human happiness.¹

¹ In ancient times the manufacture of silk was confined to the East Indies and China, where the insects that produce it are indigenous. It was thence brought to Europe in small quantities, and in early times sold at so extravagant a price, that it was deemed too expensive even for royalty. The Emperor Aurelian assigned the expense as a reason for refusing his empress a robe of silk; and our own James I., before his accession to the crown of England, had to borrow of the Earl of Mar a pair of silk stockings to appear in before the English ambassador, — a circumstance which probably led him to promote the cultivation of silk in England. The Roman authors were altogether ignorant of its origin, — some supposing it to be grown on trees, as hair grows on animals, — others that it was produced by a shell-fish similar to the mussel, which is known to throw out threads for the purpose of attaching itself to rocks, — others that it was the entrails of a sort of spider, which was fed for four years with paste, and then with the leaves of the green willow, till it burst with fat, — and others that it was the produce of a worm which built nests of clay and collected wax. The insect was at length spread into Persia; and eggs were afterwards, at the instance of the Emperor Justinian, concealed in hollow canes, by two monks, and conveyed to the isle of Cos. This emperor, in the sixth century, caused them to be introduced into Constantinople, and made an object of a public utility. They were thence successively cultivated in Greece, in Arabia, in Spain, in Italy, in France, and in all places where any hope could be indulged of their succeeding. In America, the culture of the silkworm was introduced into Virginia in the time of James I., who himself composed a book of instructions on the subject, and caused mulberry-trees, and silkworms' eggs to be sent to the colony. In Georgia also, lands were granted on condition of planting one hundred white mulberry-trees on every ten acres of cleared land. The growth of the silkworm has also been tried, but with no great success, in this country. Evelyn computed that one mulberry-tree would feed as many silkworms annually as would produce seven pounds of silk. "According to that estimate," says Barham, "the two thousand trees already planted in Chelsea Park (which take up one-third of it) will make 14,000 pounds weight of silk; to be commonly worth but twenty shillings a pound, those trees must make £14,000 per annum." During the last century, some French refugees in the south of Ireland made considerable plantations of the mulberry, and had begun the cultivation of silk with every appearance of success; but since their removal the trees have been cut down. The manufacture of silk was introduced

There are two methods of breeding silkworms; for they may be left to grow, and to remain at liberty on the trees where they are hatched; or they may be kept in a place built for that purpose, and fed every day with fresh leaves. The first method is used in China, Tonquin, and other hot countries; the other is used in those places where the animal has been artificially propagated, and still continues a stranger. In the warm climates, the silkworm proceeds from an egg, which has been glued by the parent moth upon proper parts of the mulberry-tree, and which remains in that situation during the winter. The manner in which they are situated and fixed to the tree, keeps them unaffected by the influence of the weather; so that those frosts which are severe enough to kill the tree, have no power to injure the silkworm.

The insect never proceeds from the egg till Nature has provided it a sufficient supply; and till the budding leaves are furnished, in sufficient abundance, for its support. When the leaves are put forth, the worms seem to feel the genial summons, and bursting from their little eggs, crawl upon the leaves, where they feed with a most voracious appetite. Thus they become larger by degrees; and after some months' feeding, they lay, upon every leaf, small bundles or cones of silk, which appear like so many golden apples, painted on a fine green ground. Such is the method of breeding them in the East; and without doubt it is best for the worms, and least troublesome for the feeder of them. But it is otherwise in our colder European climates; the frequent changes of the weather, and the heavy dews of our evenings, render the keeping them all night exposed, subject to so many inconveniences, as to admit of no remedy. It is true, that, by the assistance of nets, they may be preserved from the insults of birds; but the severe cold weather, which often succeeds the first heats of summer, as well as the rain and high winds, will destroy them all: and, therefore, to breed them in Europe, they must be sheltered and protected from every external injury.

For this purpose a room is chosen with a south aspect; and the windows are so well glazed as not to admit the least air: the walls are well built, and the planks of the floor exceedingly close, so as to admit neither birds nor mice, nor even so much as an insect. In the middle there should be four pillars erected, or four wooden posts, so placed as to form a pretty large square. Between these are different stories made with osier hurdles; and under each hurdle there should be a floor with an upright border all

round. These hurdles and floors must hang upon pulleys, so as to be placed or taken down at pleasure.

When the worms are hatched, some tender mulberry leaves are provided, and placed in the cloth or paper-box in which the eggs were laid, and which are large enough to hold a great number. When they have acquired some strength, they must be distributed on beds of mulberry leaves, in the different stories of the square in the middle of the room, round which a person may freely pass on every side. They will fix themselves to the leaves, and afterwards to the sticks of the hurdles, when the leaves are devoured. They have then a thread, by which they can suspend themselves on occasion, to prevent any shock by a fall; but this is by no means to be considered as the silk which they spin afterwards in such abundance. Care must be taken that fresh leaves be brought every morning, which must be strewed very gently and equally over them; upon which, the silkworms will forsake the remainder of the old leaves, which must be carefully taken away, and everything kept very clean; for nothing hurts these insects so much as moisture and uncleanness. For this reason their leaves must be gathered when the weather is dry, and kept in a dry place, if it be necessary to lay in a store. As these animals have but a short time to live, they make use of every moment, and almost continually are spinning, except at those intervals when they change their skins. If mulberry leaves be difficult to be obtained, the leaves of lettuce, or hollyhock, will sustain them; but they do not thrive so well upon their new diet; and their silk will neither be so copious nor of so good a quality.

Though the judicious choice and careful management of their diet is absolutely necessary, yet there is another precaution of equal importance; which is, to give them air, and open their chamber windows, at such times as the sun shines warmest. The place also must be kept as clean as possible; not only the several floors that are laid to receive their ordure, but the whole apartments in general. These things well observed, contribute greatly to their health and increase.

The worm, at the time it bursts the shell, is extremely small, and of a black colour; but the head is of a more shining black than the rest of the body: some days after, they begin to turn whitish, or of an ash-coloured gray. After the skin begins to grow too rigid, or the animal is stinted within it, the insect throws it off, and appears clothed anew: it then becomes larger, and much whiter, though it has a greenish cast: after some days, which are more or less, according to the different heat of the climate, or to the quality of the food, it leaves off eating, and seems to sleep for two days together: then it begins to stir, and put itself into violent motions, till the skin falls off the second time, and is thrown aside by the animal's feet. All these

into this country in 1718, at Derby, by Mr. John Lombe, who travelled into Italy to obtain the requisite information; but so jealous were the Italians of this, that according to some statements which have obtained belief, he fell a victim to their revenge, having been poisoned at the early age of twenty-nine.—Ed.

changes are made in three weeks or a month's time; after which it begins to feed once more, still in its caterpillar form, but a good deal differing from itself before its change. In a few days' time it seems to sleep again; and, when it awakes, it again changes its clothing, and continues feeding as before. When it has thus taken a sufficiency of food, and its parts are disposed for assuming the aurelia form, the animal forsakes, for the last time, all food and society, and prepares itself a retreat to defend it from external injuries, while it is seemingly deprived of life and motion.

This retreat is no other than its cone, or ball of silk, which Nature has taught it to compose with great art; and within which it buries itself, till it assumes its winged form. This cone or ball is spun from two little longish kinds of bags that lie above the intestines, and are filled with a gummy fluid, of a marigold colour. This is the substance of which the threads are formed; and the little animal is furnished with a surprising apparatus for spinning it to the degree of fineness which its occasions may require. This instrument in some measure resembles a wire-drawer's machine, in which gold or silver threads are drawn to any degree of minuteness; and through this the animal draws its thread with great assiduity. As every thread proceeds from two gum-bags, it is probable that each supplies its own; which, however, are united, as they proceed from the animal's body. If we examine the thread with a microscope, it will be found that it is flattened on one side, and grooved along its length: from hence we may infer, that it is doubled just upon leaving the body; and that the two threads stick to each other by that gummy quality of which they are possessed. Previous to spinning its web, the silkworm seeks out some convenient place to erect its cell, without any obstruction. When it has found a leaf, or a chink fitted to its purpose, it begins to wreath its head in every direction, and fastens its thread on every side to the sides of its retreat. Though all its first essays seem perfectly confused, yet they are not altogether without design: there appears, indeed, no order or contrivance in the disposal of its first threads: they are by no means laid artfully over each other, but are thrown out at random, to serve as an external shelter against rain; for nature having appointed the animal to work upon trees in the open air, its habits remain, though it is brought up in a warm apartment.

Malpighi pretends to have observed six different layers in a single cone of silk: but what may easily be observed is, that it is composed externally of a kind of rough cotton-like substance, which is called floss; within, the thread is more distinct and even; and next the body of the aurelia, the apartment seems lined with a substance of the hardness of paper, but of a much stronger consistence. It must not be supposed, that the

thread which goes to compose the cone, is rolled round, as we roll a bottom; on the contrary, it lies upon it in a very irregular manner, and winds off now from one side of the cone, and then from the other. This whole thread, if measured, will be found about three hundred yards long; and so very fine, that eight or ten of them are generally rolled off into one by the manufacturers. The cone, when completed, is in form like a pigeon's egg, and more pointed at one end than the other: at the smaller end, the head of the aurelia is generally found; and this is the place that the insect, when converted into a moth, is generally seen to burst through.²

It is generally a fortnight or three weeks before the aurelia is changed into a moth; but no sooner is the winged insect completely formed, than having divested itself of its aurelia skin, it prepares to burst through its cone, or outward prison: for this purpose it extends its head towards the point of the cone, butts with its eyes, which are rough, against the lining of its cell, wears it away, and at last pushes forward, through a passage which is small at first, but which enlarges as the animal increases its efforts for emancipation; while the tattered remnants of its aurelia skin lie in confusion within the cone, like a bundle of dirty linen.

The animal, when thus set free from its double confinement, appears exhausted with fatigue, and seems produced for no other purpose but to transmit a future brood. It neither flies nor eats; the male only seeking the female, whose eggs he impregnates; and their union continues for four days, without interruption. The male dies immediately after separation from his mate; and she survives him only till she has laid her eggs, which are not hatched into worms till the ensuing spring.

² The length of the unbroken thread in a cocoon or cone of silk varies from six hundred to a thousand feet; and as it is all spun double by the insect, it will amount to nearly two thousand feet of silk, the whole of which does not weigh above three grains and a half: five pounds of silk from ten thousand cocoons is considerably above the usual average. When we consider, therefore, the enormous quantity of silk which is used at present, the number of worms employed in producing it will almost exceed our comprehension. The manufacture of the silk, indeed, gives employment, and furnishes subsistence, to several millions of human beings; and we may venture to say, that there is scarcely an individual in the civilized world who has not some article made of silk in his possession. There are not only several varieties of the common silkworm but other species of caterpillars, which spin silk capable of being manufactured, though not of so good qualities as the common silk. None of our European insects, however, seem to be well fitted for this purpose, though it has been proposed by Fabricius and others to try the crimson under-wing. M. Latreille quotes from the 'Recreations of Natural history,' by Wilhelm, the statement that the cocoons of the emperor-moth had been successfully tried in Germany, by M. Wetzel Hegele de Berchtholdsdorf, under an imperial patent. —Ed.

however, there are few of these animals sufficient to come to a state of maturity: for as their passing through the cone destroys the silk, the facturers take care to kill the aurelia, by exposing it to the sun, before the moth comes to maturity. This done, they take off the floss, throw the cones into warm water, stirring till the first thread offers them a clue for pulling all off. They generally take eight of the like threads together; the cones being still

kept under water, till a proper quantity of the silk is wound off: however, they do not take all; for the latter parts grow weak, and are of a bad colour. As to the paper-like substance which remains, some stain it with a variety of colours, to make artificial flowers; others let it lie in the water, till the glutinous matter which cements it is all dissolved: it is then carded like wool, spun with a wheel, and converted into silk stuffs of an inferior kind.

BOOK IV.

INSECTS OF THE FOURTH ORDER.

CHAP. I.

THE FOURTH ORDER OF INSECTS IN GENERAL.

In the foregoing part we treated of caterpillars passing into butterflies; in the present will be the history of grubs changing into their corresponding winged animals. These, like the former, undergo their transformation, and appear as maggots or maggots, as aurelias, and at last as winged insects. Like the former, they are bred from eggs; they feed in their reptile state; they are motionless and lifeless, as aurelias; and they propagate, when furnished with wings. They differ in many respects: the grub or caterpillar wants the number of feet which the butterfly is seen to have; the aurelia is not so much wrapped up, but that its feet and its wings appear. The perfect animal, when emanated, also has its wings either cased, or transparent like gauze; not coloured with that beautiful painted dust which adorns the wings of the butterfly.

In this class of insects, therefore, we may place the whole tribe, that are first laid as eggs, then excluded as maggots or grubs, then change into aurelias, with their legs and wings not developed but appearing; and lastly, assuming the form in which state they propagate their kind. Some of these have four transparent wings, as the flies; some have two membranous cases to their wings, as beetles; and some have but two wings, as the bees, and ants. Here, therefore, we will place the bee, the wasp, the humble-bee, the chneumon fly, the gnat, the tipula or long-leg beetle, the may-bug, the glow-worm, the ant. The transformations which all these undergo, are pretty nearly similar; and though different animals in form, yet are produced in the same manner.

CHAP. II.

OF THE BEE.

To give a complete history of this insect in a few pages, which some have exhausted volumes in describing, and whose nature and properties still continue in dispute, is impossible. It will be sufficient to give a general idea of the animal's operations; which, though they have been studied for more than two thousand years, are still but incompletely known. The account given us by Reaumur is sufficiently minute; and, if true, sufficiently wonderful: but I find many of the facts which he relates, doubted by those who are most conversant with bees: and some of them actually declared not to have a real existence in nature.

It is unhappy, therefore, for those whose method demands a history of bees, that they are unfurnished with those materials which have induced so many observers to contradict so great a naturalist. His life was spent in the contemplation; and it requires an equal share of attention, to prove the error of his discoveries. Without entering, therefore, into the dispute, I will take him for my guide; and just mention, as I go along, those particulars in which succeeding observers have begun to think him erroneous. Which of the two are right, time only can discover; for my part, I have only heard one side, for as yet none have been so bold as openly to oppose Reaumur's delightful researches.

There are three different kinds of bees in every hive. First, the labouring bees, which make up the far greatest number, and are thought to be neither male nor female, but merely born for the purposes of labour, and continuing the breed, by supplying the young with provision, while yet in their helpless state. The second sort are

the drones; they are of a darker colour, longer, and more thick by one-third than the former; they are supposed to be the males; and there is not above a hundred of them in a hive of seven or eight thousand bees. The third sort is much larger than either of the former, and still fewer in number; some assert that there is not above one in every swarm: but this later observers affirm not to be true, there being sometimes five or six in the same hive. These are called queen-bees, and are said to lay all the eggs from which the whole swarm is hatched in a season.

In examining the structure of the common working bee, the first remarkable part that offers is the trunk, which serves to extract the honey from flowers. It is not formed, like that of other flies, in the manner of a tube, by which the fluid is to be sucked up; but like a besom to sweep, or a tongue to lick it away. The animal is furnished also with teeth, which serve it in making wax. This substance is gathered from flowers, like honey; it consists of that dust or farina which contribute to the fecundation of plants, and is moulded into wax by the little animal at leisure. Every bee, when it leaves the hive to collect this precious store, enters into the cup of the flower, particularly such as seem charged with the greatest quantity of this yellow farina. As the animal's body is covered over with hair, it rolls itself within the flower, and soon becomes quite covered with the dust, which it soon after brushes off with its two hind-legs, and kneads into two little balls. In the thighs of the hind-legs there are two cavities, edged with hair, and into these, as into a basket, the animal sticks its pellets. Thus employed, the bee flies from flower to flower, increasing its store, and adding to its stock of wax; until the ball upon each thigh becomes as big as a grain of pepper: by this time, having got a sufficient load, it returns, making the best of its way to the hive.¹

¹ The celebrated John Hunter shrewdly remarked that the pellets of pollen seen on the thighs of bees are of different colours on different bees, while the shade of the new-made comb is always uniform; and therefore he concluded that pollen was not the origin of wax. Pollen also, he observed, is collected with greater avidity for old hives, where the comb is complete, than for those where it is only begun, which would hardly be the case were it the material of wax. He found that when the weather was cold and wet in June, so that a young swarm was prevented from going abroad, as much comb was constructed as had been made in an equal time when the weather was favourable and fine. The pellets of pollen on the thighs being thence proved not to be wax, he came to the conclusion that it was an external secretion originating between the plates of the belly. When he first observed this, he felt not a little embarrassed to explain the phenomenon, and doubted whether new plates were forming, or whether bees cast the old ones as lobsters do their shells. By melting the scales, he ascertained at least that they were wax; and his opinion was confirmed by the fact, that the scales are only to be found during the season when the combs are constructed. But he did not succeed in completing the discovery by

The belly of the bee is divided into six rings, which sometimes shorten the body, by slipping one over the other. It contains within it, beside the intestines, the honey-bag, the venom-bag, and the sting. The honey-bag is as transparent as crystal, containing the honey that the bee has brushed from the flowers; of which the greater part is carried to the hive, and poured into the cells of the honey-comb, while the remainder serves for the bee's own nourishment; for, during summer, it never touches what has been laid up for the winter. The sting which serves to defend this little animal from its enemies, is composed of three parts; the sheath and two darts, which are extremely small and penetrating. Both the darts have several small points or barbs, like those of a fish-hook, which render the sting more painful, and make the darts rankle in the wound. Still, however, this instrument would be very slight, did not the bee poison the wound. The sheath, which has a sharp point, makes the first impression; which is followed by that of the darts, and then the venomous liquor is poured in. The sheath sometimes sticks so fast in the wound, that the animal is obliged to leave it behind; by which the bee soon after dies, and the wound is considerably inflamed. It might at first appear well for mankind, if the bee were without its sting; but upon recollection, it will be found, that the little animal would then have too many rivals in sharing its labours. A hundred other lazy animals, fond of honey, and hating labour, would intrude upon the sweets of the hive; and the treasure would be carried off for want of armed guardians to protect it.

From examining the bee singly, we now come to consider it in society, as an animal not only subject to laws, but active, vigilant, laborious, and disinterested. All its provisions are laid up for the community; and all its arts in building a cell, designed for the benefit of posterity. The substance with which bees build their cells, is wax; which is fashioned into convenient apartments for themselves and their young. When they begin to work in their hives, they divide themselves into four companies: one of which roves in the fields in search of materials; another employs itself in laying out the bottom and partitions of their cells; a third is employed in making the inside smooth from the corners and angles; and the fourth company bring food for the rest, or relieve those who return with their respective burdens. But they are not kept constant to one employment; they often change the tasks assigned them: those that have been

observing the bees actually detach the scales, though he conjectured they might be taken up by others, if they were once shaken out from between the rings. That wax is secreted, is proved both by the wax pouches within the rings of the abdomen, and by actual experiment. Huber and others fed bees entirely upon honey or sugar, and, notwithstanding, wax was produced and combs formed as if they had been at liberty to select their food.—ED.

at work, being permitted to go abroad; and those that have been in the fields already, take their places. They seem even to have signs, by which they understand each other; for when any of them wants food, it bends down its trunk to the bee from whom it is expected, which then opens its honey-bag, and lets some drops fall into the other's mouth, which is at that time open to receive it. Their diligence and labour is so great, that in a day's time they are able to make cells, which lie upon each other, numerous enough to contain three thousand bees.

If we examine their cells, they will be found formed in the exactest proportion. It was said by Pappus, an ancient geometrician, that of all other figures, hexagons were the most convenient; for when placed touching each other, the most convenient room would be given, and the smallest lost. The cells of the bees are perfect hexagons: these, in every honey-comb, are double, opening on either side, and closed at the bottom. The bottoms are composed of little triangular panes, which, when united together, terminate in a point, and lie exactly upon the extremities of other panes of the same shape, in opposite cells. These lodgings have spaces, like streets, between them, large enough to give the bees a free passage in and out; and yet narrow enough to preserve the necessary heat. The mouth of every cell is defended by a border, which makes the door a little less than the inside of the cell, which serves to strengthen the whole. These cells serve for different purposes; for laying up their young; for their wax, which in winter becomes a part of their food; and for their honey, which makes their principal subsistence.

It is well known that the habitation of bees ought to be very close; and what their hives want, from the negligence or unskilfulness of man, these animals supply by their own industry: so that it is their principal care, when first hived, to stop up all the crannies. For this purpose they make use of a resinous gum, which is more tenacious than wax, and differs greatly from it. This the ancients called *propolis*: it will grow considerably hard in June; though it will in some measure soften by heat; and is often found different in consistence, colour, and smell. It has generally an agreeable aromatic odour when it is warmed; and by some it is considered as a most grateful perfume. When the bees begin to work with it, it is soft, but it acquires a firmer consistence every day; till at length it assumes a brown colour, and becomes much harder than wax. The bees carry it on their hinder legs; and some think it is met with on the birch, the willow, and poplar. However it is procured, it is certain that they plaster the inside of their hives with this composition.

If examined through a glass hive, from the hurry the whole swarm is in, the whole appears at first like anarchy and confusion; but the spectator soon finds every animal diligently employed,

and following one pursuit, with a settled purpose. Their teeth are the instruments by which they model and fashion their various buildings, and give them such symmetry and perfection. They begin at the top of the hive; and several of them work at a time at the cells which have two faces. If they are stinted with regard to time, they give the new cells but half the depth which they ought to have; leaving them imperfect, till they have sketched out the number of cells necessary for the present occasion. The construction of their combs costs them a great deal of labour: they are made by insensible additions; and not cast at once in a mould, as some are apt to imagine. There seems no end of their shaping, finishing, and turning them neatly up. The cells for their young are most carefully formed; those designed for lodging the drones, are larger than the rest; and that for the queen-bee the largest of all. The cells in which the young brood are lodged, serve at different times for containing honey; and this proceeds from an obvious cause: every worm, before it is transformed into an aurelia, hangs its old skin on the partitions of its cell; and thus, while it strengthens the wall, diminishes the capacity of its late apartment. The same cell, in a single summer, is often tenanted by three or four worms in succession; and the next season by three or four more. Each worm takes particular care to fortify the pannels of its cell, by hanging up its spoils there: thus, the partitions being lined six or eight deep, become at last too narrow for a new brood, and are converted into storehouses for honey.

Those cells where nothing but honey is deposited, are much deeper than the rest. When the harvest of honey is so plentiful that they have not sufficient room for it, they either lengthen their combs, or build more; which are much longer than the former. Sometimes they work at three combs at a time; for when there are three work-houses, more bees may be thus employed, without embarrassing each other.

But honey, as was before observed, is not the only food upon which these animals subsist. The meal of flowers, of which their wax is formed, is one of their most favourite repasts. This is a diet which they live upon during the summer; and of which they lay up a large winter provision. The wax of which their combs are made, is no more than this meal digested, and wrought into a paste. When the flowers upon which bees generally feed, are not fully blown, and this meal or dust is not offered in sufficient quantities, the bees pinch the tops of the stamina in which it is contained, with their teeth; and thus anticipate the progress of vegetation. In April and May, the bees are busy, from morning to evening, in gathering this meal; but when the weather becomes too hot in the midst of summer, they work only in the morning.

The bee is furnished with a stomach for its wax, as well as its honey. In the former of the

two, their powder is altered, digested, and concocted into real wax, and is thus ejected by the same passage by which it was swallowed. Every comb, newly made, is white: but it becomes yellow as it grows old, and almost black when kept too long in the hive. Beside the wax thus digested, there is a large portion of the powder kneaded up for food in every hive, and kept in separate cells for winter-provision. This is called by the country people, bee-bread; and contributes to the health and strength of the animal during winter. Those who rear bees may rob them of their honey, and feed them during the winter with treacle; but no proper substitute has yet been found for the bee-bread; and, without it, the animals become consumptive, and die.

As for the honey, it is extracted from that part of the flower called the nectareum. From the mouth this delicious fluid passes into the gullet; and then into the first stomach, or honey-bag, which, when filled, appears like an oblong bladder. Children that live in country places, are well acquainted with this bladder; and destroy many bees, to come at their store of honey. When a bee has sufficiently filled its first stomach, it returns back to the hive, where it disgorges the honey into one of the cells. It often happens that the bee delivers its store to some other, at the mouth of the hive, and flies off for a fresh supply. Some honeycombs are always left open for common use; but many others are stopped up, till there is a necessity of opening them. Each of these is covered carefully with wax; so close, that the covers seem to be made at the very instant the fluid is deposited within them.

Having thus given a cursory description of the insect, individually considered, and of the habitation it forms, we next come to its social habits and institutions: and, in considering this little animal attentively, after the necessary precautions for the immediate preservation of the community, its second care is turned to the continuance of posterity. How numerous soever the multitude of bees may appear in one swarm, yet they all owe their original to a single parent, which is called the *Queen-Bee*. It is indeed surprising that a single insect shall, in one summer, give birth to above twenty thousand young: but, upon opening her body the wonder will cease; as the number of eggs appearing at one time amounts to five thousand. This animal, whose existence is of so much importance to her subjects, may easily be distinguished from the rest by her size, and the shape of her body. On her safety depends the whole welfare of the commonwealth; and the attentions paid her by all the rest of the swarm, evidently show the dependence her subjects have upon her security. If this insect be carefully observed, she will be seen at times attended with a numerous retinue, marching from cell to cell, plunging the extremity of her body into many of them, and leaving a small egg in each.

The bees which generally compose her train are thought to be males, which serve to impregnate her by turns. These are larger and blacker than the common bees; without stings, and without industry. They seem formed only to transmit a posterity; and to attend the queen, whenever she thinks proper to issue from the secret retreats of the hive, where she most usually resides. Upon the union of these two kinds depends all expectations of a future progeny; for the working bees are of no sex, and only labour for another offspring: yet such is their attention to their queen, that if she happens to die, they will leave off working, and take no further care of posterity. If, however, another queen is, in this state of universal despair, presented them, they immediately acknowledge her for their sovereign, and once more diligently apply to their labour. It must be observed, however, that all this fertility of the queen-bee, and the great attentions paid to her by the rest, are controverted by more recent observers. They assert, that the common bees are parents themselves; that they deposit their eggs in the cells which they have prepared; that the females are impregnated by the males, and bring forth a progeny, which is wholly their own.²

However, to go on with their history, as delivered us by Mr. Reaumur.—When the queen-bee has deposited the number of eggs necessary in the cells, the working bees undertake the care of the rising posterity. They are seen to leave off their usual employments; to construct proper receptacles for eggs; or to complete those that are already formed. They purposely build little cells, extremely solid, for the young; in which they employ a great deal of wax: those designed for lodging the males, as was already observed, are larger than the rest; and those for the queen-bees the largest of all. There is usu-

² Swammerdam was unable to discover the external termination of the oviduct of the queen; but Huber has ascertained it to be in the last ring of the abdomen; also that the eggs are dropped by it into a kind of cavity, from which they are quickly discharged. Huber obtained a number of females after Schirach's method; and, on the 10th of July, successively released three, which were four or five days old, and still in a virgin state. Two departed several times; their absence was short and fruitless. The third profited better by her freedom: the first and second time her absence was short; but the last continued thirty-five minutes, when she returned in a very different condition, and such as admitted no doubt of what had happened, for she exhibited the organs of the male that had rendered her a mother. They were disengaged by herself; she was allowed to enter her hive, and its entrance adapted so that she could not leave it unnoticed. No eggs were found in it on the seventeenth; the queen was as slender as the first day; therefore she had not been fructified. Being again set at liberty, she departed twice, and returned with evidence of a second union. The eggs which she laid after this event showed that it had been more successful; but a repetition is rarely requisite. It was remarked on only two occasions.—ED

ally but one egg deposited in every cell; but when the fecundity of the queen is such, that it exceeds the number of cells already prepared, there are sometimes three or four eggs crowded together in the same apartment. But this is an inconvenience that the working bees will by no means suffer. They seem sensible that two young ones, stuffed up in the same cell, when they grow larger, will but embarrass and at last destroy each other: they therefore take care to leave a cell to every egg; and remove or destroy the rest.

The single egg that is left remaining, is fixed to the bottom of the cell, and touches it but in a single point. A day or two after it is deposited, the worm is excluded from the shell of the egg, having the appearance of a maggot rolled up in a ring, and lying softly on a bed of a whitish-coloured jelly; upon which also the little animal begins to feed. In the meantime, the instant it appears, the working bees attend it with the most anxious and parental tenderness; they furnish it every hour with a supply of this whitish substance, on which it feeds and lies; and watch the cell with unremitting care. They are nurses that have a greater affection for the offspring of others, than many parents have for their own children. They are constant in visiting each cell, and seeing that nothing is wanting; preparing the white mixture, which is nothing but a composition of honey and wax, in their own bowels, with which they feed them. Thus attended, and plentifully fed, the worm, in less than six days' time, comes to its full growth, and no longer accepts the food offered it. When the bees perceive that it has no further occasion for feeding, they perform the last offices of tenderness, and shut the little animal up in its cell: walling up the mouth of its apartment with wax: where they leave the worm to itself; having secured it from every external injury.

The worm is no sooner left enclosed, but from a state of inaction, it begins to labour, extending and shortening its body; and by this means lining the walls of its apartment with a silken tapestry, which it spins in the manner of caterpillars, before they undergo their last transformation. When their cell is thus prepared, the animal is soon after transformed into an aurelia; but differing from that of the common caterpillar, as it exhibits not only the legs, but the wings of the future bee, in its present state of inactivity. Thus, in about twenty or one and twenty days after the egg was laid, the bee is completely formed, and fitted to undergo the fatigues of its state. When all its parts have acquired their proper strength and consistence, the young animal opens its prison, by piercing with its teeth the waxy door that confines it. When just freed from its cell, it is as yet moist, and incommenced with the spoils of its former situation: but the officious bees are soon seen to flock round it, and to lick it clean on all sides with their trunks;

while another band, with equal assiduity, are observed to feed it with honey: others again begin immediately to cleanse the cell that has been just left; to carry the ordure out of the hive, and to fit the place for a new inhabitant. The young bee soon repays their care by its industry; for as soon as ever its external parts become dry, it discovers its natural appetites for labour, and industriously begins the task, which it pursues unremittingly through life. The toil of man is irksome to him, and he earns his subsistence with pain; but this little animal seems happy in its pursuits, and finds delight in all its employments.

When just freed from the cell, and properly equipped by its fellow-bees for duty, it at once issues from the hive, and instructed only by Nature, goes in quest of flowers, chooses only those that yield it a supply, rejects such as are barren of honey, or have been already drained by other adventurers; and when loaded, is never at a loss to find its way back to the common habitation. After this first sally, it begins to gather the mealy powder that lies on every flower, which is afterwards converted into wax; and with this, the very first day, it returns with two large balls stuck to its thighs.

When bees first begin to break their prisons, there are generally above a hundred excluded in one day. Thus, in the space of a few weeks, the number of the inhabitants in one hive, of moderate size, becomes so great, that there is no place to contain the new comers; and they are scarcely excluded from the cell, when they are obliged, by the old bees, to sally forth in quest of new habitations. In other words, the hive begins to swarm, and the new progeny prepares for exile.

While there is room enough in the hive, the bees remain quietly together; it is necessity alone that compels the separation. Sometimes, indeed, the young brood, with graceless obstinacy, refuse to depart, and even venture to resist their progenitors. The young ones are known by being browner than the old, with whiter hair; the old ones are of a lighter colour, with red hair. The two armies are therefore easily distinguishable, and dreadful battles are often seen to ensue. But the victory almost ever terminates with strict poetical justice in favour of the veterans, and the rebellious offspring are driven off, not without loss and mutilation.

In different countries, the swarms make their appearance at different times of the year, and there are several signs previous to this intended migration. The night before, an unusual buzzing is heard in the hive; in the morning, though the weather be soft and inviting, they seem not to obey the call, being intent on more important meditations within. All labour is discontinued in the hive; every bee is either employed in forcing, or reluctantly yielding, a submission; at length, after some noise and tumult, a queen-bee

is chosen to guard, rather than conduct the young colony to other habitations, and then they are marshalled without any apparent conductor. In less than a minute they leave their native abode, and forming a cloud round their protectress, they set off, without seeming to know the place of their destination; *the world before them, where to choose their place of rest.* The usual time of swarming is from ten in the morning to three in the afternoon, when the sun shines bright, and invites them to seek their fortunes. They flutter for a while in the air, like flakes of snow, and sometimes undertake a distant journey, but more frequently are contented with some neighbouring asylum; the branch of a tree, a chimney-top, or some other exposed situation. It is, indeed, remarkable, that all those animals, of whatever kind, that have long been under the protection of man, seem to lose a part of their natural sagacity in providing for themselves. The rabbit, when domesticated, forgets to dig holes, the hen to build a nest, and the bee to seek a shelter that shall protect it from the inclemencies of winter. In those countries where the bees are wild, and unprotected by man, they are always sure to build their waxen cells in the hollow of a tree; but with us they seem improvident in their choice, and the first green branch that stops their flight, seems to be thought sufficient for their abode through winter. However, it does not appear that the queen chooses the place where they are to alight, for many of the stragglers, who seemed to be pleased with a particular branch, go and settle upon it; others are seen to succeed; and, at last, the queen herself, when she finds a sufficient number there before her, goes to make it the place of her head-quarters. When the queen is settled, the rest of the swarm soon follow; and, in a quarter of an hour, the whole body seem to be at ease. It sometimes is found that there are two or three queens to a swarm, and the colony is divided into parties; but it most usually happens that one of these is more considerable than the others, and the bees, by degrees, desert the weakest, to take shelter under the most powerful protector. The deserted queen does not long survive this defeat; she takes refuge under the new monarch, and is soon destroyed by her jealous rival. Till this cruel execution is performed, the bees never go out to work; and if there should be a queen-bee belonging to the new colony left in the old hive, she always undergoes the fate of the former. However, it must be observed, that the bees never sacrifice any of their queens, when the hive is full of wax and honey; for there is at that time no danger in maintaining a plurality of breeders.

When the swarm is thus conducted to a place of rest, and the policy of government is settled, the bees soon resume their former labours. The making cells, storing them with honey, impregnating the queen, making proper cells for the

reception of the rising progeny, and protecting them from external danger, employs their unceasing industry. But soon after, and towards the latter end of summer, when the colony is sufficiently stored with inhabitants, a most cruel policy ensues. The drone bees, which are (as has been said) generally in a hive to the number of a hundred, are marked for slaughter. These, which had hitherto led a life of indolence and pleasure, whose only employment was in impregnating the queen, and rioting upon the labours of the hive, without aiding in the general toil, now share the fate of most voluptuaries, and fall a sacrifice to the general resentment of society.

The working bees in a body declare war against them; and in two or three days' time the ground all round the hive is covered with their dead bodies. Nay, the working bees will even kill such drones as are yet in the worm state, in the cell, and eject their bodies from the hive among the general carnage.

When a hive sends out several swarms in the year, the first is always the best, and the most numerous. These having the whole summer before them, have the more time for making wax and honey, and consequently their labours are the most valuable to the proprietor. Although the swarm chiefly consists of the youngest bees, yet it is often found that bees of all ages compose the multitude of emigrants, and it often happens that bees of all ages are seen remaining behind. The number of them is always more considerable than that of some populous cities, for sometimes upwards of forty thousand are found in a single hive. So large a body may well be supposed to work with great expedition; and in fact, in less than twenty-four hours they will make combs above twenty inches long, and seven or eight broad. Sometimes they will half fill their hives with wax in less than five days. In the first fifteen days, they are always found to make more wax than they do afterwards during the rest of the year.

Such are the outlines of the natural history of these animals, as usually found in our own country. How they are treated, so as to produce the greatest quantity of honey, belongs rather to the rural economist than the natural historian; volumes have been written on the subject, and still more remains equally curious and new. One thing, however, it may be proper to observe, that a farm, or a country, may be overstocked with bees, as well as with any other sort of animal; for a certain number of hives always require a certain number of flowers to subsist on. When the flowers near home are rifled, then are these industrious insects seen taking more extensive ranges: but their abilities may be overtaxed; and if they are obliged, in quest of honey, to go too far from home, they are over-wearied in the pursuit, they are devoured by birds, or beat down by the winds and rain.

From a knowledge of this, in some parts of

France and Piedmont they have contrived, as I have often seen, a kind of floating bee-house.

They have on board one barge threescore or a hundred bee-hives, well defended from the inclemency of an accidental storm: and with these the owners suffer themselves to float gently down the river. As the bees are continually choosing their flowery pasture along the banks of the stream, they are furnished with sweets before unrified; and thus a single floating bee-house yields the proprietor a considerable income. Why a method similar to this has never been adopted in England, where we have more gentle rivers, and more flowery banks, than in any other part of the world, I know not: certainly it might be turned to advantage, and yield the possessor a secure, though perhaps a moderate income.

Having mentioned the industry of these admirable insects, it will be proper to say something of the effects of their labour, of that wax and honey which are turned by man to such various uses. Bees gather two kinds of wax; one coarse, and the other fine. The coarser sort is bitter, and with this, which is called *propolis*, they stop up all the holes and crevices of their hives.³ It

³ It was strongly suspected by Reaumur, that the bees collected the propolis from those trees that are known to produce a similar gummy resin, such as the poplar, the birch, and the willow; but he was thrown into doubt by not being able to detect the bees in the act of procuring it, and by observing them to collect it where none of those trees, nor any other of the same description, grew. His bees also refused to make use of bitumen, and other resinous substances with which he supplied them, though Mr. Knight was more successful. Huber at length set the question at rest. "For many years," says he, "I had fruitlessly endeavoured to find them on trees producing an analogous substance, though multitudes had been seen returning laden with it. In July, some branches of the wild poplar, which had been cut since spring, with very large buds, full of a reddish, viscous, odoriferous matter, were brought to me, and I planted them in vessels before hives, in the way of the bees going out to forage, so that they could not be insensible of their presence. Within a quarter of an hour they were visited by a bee, which separating the sheath of a bud with its teeth, drew out threads of the viscous substance, and lodged a pellet of it in one of the baskets of its limbs; from another bud it collected another pellet for the opposite limb, and departed to the hive. A second bee took the place of the former in a few minutes, following the same procedure. Young shoots of poplar, recently cut, did not seem to attract these insects, as their viscous matter had less consistence than the former. Different experiments proved the identity of this substance with propolis."

Mr. Knight, President of the Horticultural Society, discovered by accident an artificial substance, more attractive than any of the reasons experimentally tried by Reaumur. Having caused the decorticated part of a tree to be covered with a cement, composed of bees'-wax and turpentine, he observed that this was frequented by hive-bees, who, finding it to be a very good propolis ready-made, detached it from the tree by their mandibles, and then, as usual, passed it from the first leg to the second, and so on. When one bee had thus collected its load, another often came behind and despoiled it of all it had col-

lected; a second and a third load were frequently lost in the same manner; and yet the patient insect pursued its operations without manifesting any signs of anger. Probably the latter circumstance, at which Mr. Knight seems to have been surprised, was nothing more than an instance of the division of labour so strikingly exemplified in every part of the economy of bees.—Ed.

is of a more resinous nature than the fine wax, and is consequently better qualified to resist the moisture of the season, and preserve the works warm and dry within. The fine wax is as necessary to the animal's preservation as the honey itself. With this they make their lodgings, with this they cover the cells of their young, and in this they lay up their magazines of honey. This is made, as has been already observed, from the dust of flowers, which is carefully kneaded by the little insect, then swallowed, and having undergone a kind of digestion, is formed into the cells, which answer such a variety of purposes. To collect this, the animal rolls itself in the flower it would rob, and thus takes up the vegetable dust with the hair of its body. Then carefully brushing it into a lump, with its fore-paws it thrusts the composition into two cavities behind the thighs, which are made like spoons to receive the wax, and the hair that lines them serves to keep it from falling.

As of wax, there are also two kinds of honey; the white and the yellow. The white is taken without fire from the honey-combs. The yellow is extracted by heat, and squeezed through bags, in a press. The best honey is new, thick, and granulated, of a clear transparent white colour, of a soft and aromatic smell, and of a sweet lively taste. Honey made in mountainous countries is preferable to that of the valley. The honey made in the spring is more highly esteemed than that of autumn, when the flowers begin to fade, and lose their fragrance.

The bees are nearly alike in all parts of the world; yet there are differences worthy our notice. In Guadaloupe, the bee is less by one half than the European, and more black and round. They have no sting, and make their cells in hollow trees; where, if the hole they meet with is too large, they form a sort of waxen house of the shape of a pear, and in this they lodge and store their honey, and lay their eggs. They lay up their honey in waxen vessels, of the size of a pigeon's egg, of a black or deep violet colour; and these are so joined together, that there is no space left between them. The honey never congeals, but is fluid, of the consistence of oil, and the colour of amber. Resembling these, there are found little black bees, without a sting, in all the tropical climates; and though these countries are replete with bees like our own, yet these form the most useful and laborious tribe in that part of the world. The honey they produce is neither so unpalatable nor so surfeiting as ours; and the wax is so soft that it is only

lected; a second and a third load were frequently lost in the same manner; and yet the patient insect pursued its operations without manifesting any signs of anger. Probably the latter circumstance, at which Mr. Knight seems to have been surprised, was nothing more than an instance of the division of labour so strikingly exemplified in every part of the economy of bees.—Ed.

used for medicinal purposes, it being never found hard enough to form into candles, as in Europe.

Of insects that receive the name of bees among us, there are several; which, however, differ very widely from that industrious social race we have been just describing. The Humble-bee is the largest of all this tribe, being as large as the first joint of one's middle finger. These are seen in every field, and perched on every flower. They build their nest in holes in the ground, of dry leaves, mixed with wax and wood, defended with moss from the weather. Each humble-bee makes a separate cell about the size of a small nutmeg, which is round and hollow, containing the honey in a bag. Several of these cells are joined together in such a manner, that the whole appears like a cluster of grapes. The females, which have the appearance of wasps, are very few, and their eggs are laid in cells, which the rest soon cover over with wax. It is uncertain whether they have a queen or not; but there is one much larger than the rest, without wings, and without hair, and all over black, like polished ebony. This goes and views all the works, from time to time, and enters into the cell, as if it wanted to see whether everything was done right. In the morning the young humble-bees are very idle, and seem not at all inclined to labour, till one of the largest, about seven o'clock, thrusts half its body from a hole designed for that purpose, and seated on the top of the nest, beats its wings for twenty minutes successively, buzzing the whole time, till the whole colony is put in motion. The humble-bees gather honey as well as the common bees; but it is neither so fine nor so good, nor the wax so clean, or so capable of fusion.

Beside the bees already mentioned, there are various kinds among us, that have much the appearance of honey-makers, and yet make only wax. The Wood-bee is seen in every garden. It is rather larger than the common queen-bee; its body of a bluish black, which is smooth and shining. It begins to appear at the approach of spring, and is seen flying near walls exposed to a sunny aspect. This bee makes its nest in some piece of wood, which it contrives to scoop and hollow for its purpose.⁴ This, however, is never

done in trees that are standing, for the wood it makes choice of is half rotten. The holes are not made directly forward, but turning to one side, and have an opening sufficient to admit one's

such a work is going forward. It is at least certain the male is never seen giving his assistance, and he seldom if ever approaches the neighbourhood. The female carpenter-bee has a task to perform no less arduous than the mason-bee; for though the wood may be tolerably soft, she can only cut out a very small portion at a time."

"The violet carpenter-bee usually selects an upright piece of wood, into which she bores obliquely for about an inch; and then, changing the direction, works perpendicularly, and parallel to the sides of the wood, for twelve or fifteen inches, and half-an-inch in breadth. Sometimes the bee is contented with one or two of these excavations; at other times, when the wood is adapted to it, she scoops out three or four—a task which sometimes requires several weeks of incessant labour. The tunnel in the wood, however, is only one part of the work; for the little architect has afterwards to divide the whole into cells, somewhat less than an inch in depth. It is necessary, for the proper growth of her progeny, that each should be separated from the other, and be provided with adequate food. She knows, most exactly, the quantity of food which each grub will require during its growth; and she therefore does not hesitate to cut it off from any additional supply. In constructing her cells, she does not employ clay, like the bee which we have mentioned above, but the sawdust, if we may call it so, which she has collected in gnawing out the gallery. It would not, therefore, have suited her design to scatter this about, as our carpenter-bee did. The violet-bee, on the contrary, collects her gnawings into a little store-heap for future use, at a short distance from her nest. She proceeds thus:—At the bottom of her excavation she deposits an egg, and over it fills a space nearly an inch high with the pollen of flowers, made into a paste with honey. She then covers this over with a ceiling composed of cemented sawdust, which also serves for the floor of the next chamber above it. For this purpose, she cements round the wall a ring of wood chips, taken from her store-heap; and within this ring forms another, gradually contracting the diameter till she has constructed a circular plate, about the thickness of a crown-piece, and of considerable hardness. This plate of course exhibits concentric circles, somewhat similar to the annual circles in the cross section of a tree. In the same manner she proceeds till she has completed ten or twelve cells; and then she closes the main entrance with a barrier of similar materials.

"Let us compare the progress of this little joiner with a human artisan—one who has been long practised in his trade, and has the most perfect and complicated tools for his assistance. The bee has learned nothing by practice; she makes her nest but once in her life, but it is then as complete and finished as if she had made a thousand. She has no pattern before her—but the Architect of all things has impressed a plan upon her own mind, which she can realize without scale or compasses. Her two sharp teeth are the only tools with which she is provided for her laborious work; and yet she bores a tunnel, twelve times the length of her own body, with greater ease than the workman who bores into the earth for water, with his apparatus of augers adapted to every soil. Her tunnel is clean and regular; she leaves no chips at the bottom, for she is provident of her materials. Further, she has an exquisite piece of joinery to perform, when her ruder labour is accomplished. The patient bee works her rings from

⁴ "We have frequently witnessed," says Mr. Rennie, "the operations of these ingenious little workers, who are particularly partial to posts, palings, and the wood-work of houses which has become soft by beginning to decay. Wood actually decayed, or affected by dry-rot, they seem to reject as unfit for their purposes; but they make no objections to any hole previously drilled, provided it be not too large; and, like the mason-bees they not unfrequently take possession of an old nest, a few repairs being all that in this case is necessary. When a new nest is to be constructed, the bee proceeds to chisel sufficient space for it out of the wood with her jaws. We say *her*, because the task in this instance, as in most others of solitary bees and wasps, devolves solely upon the female, the male taking no concern in the affair, and probably being altogether ignorant that

middle finger, from whence runs the inner apartment, generally twelve or fifteen inches long. The instruments used in boring these cavities are their teeth; the cavity is usually branched into three or four apartments; and in each of these they lay their eggs, to the number of ten or twelve, each separate and distinct from the rest: the egg is involved in a sort of paste, which serves at once for the young animal's protection and nourishment. The grown bees, however, feed upon small insects, particularly a louse, of a reddish brown colour, of the size of a small pin's head.

Mason-bees make their cells with a sort of mortar made of earth, which they build against a wall that is exposed to the sun. The mortar, which at first is soft, soon becomes as hard as stone, and in this their eggs are laid. Each nest contains seven or eight cells, an egg in every cell, placed regularly one over the other. If the nests remain unhurt, or want but little repairs, they make use of them the year ensuing: and thus they often serve three or four years successively. From the strength of their houses, one would think these bees in perfect security; yet none are more exposed than they. A worm with very strong teeth is often found to bore into their little fortifications, and devour their young.

The Ground-bee builds its nest in the earth, wherein it makes round holes, five or six inches deep; the mouth being narrow, and only just sufficient to admit the little inhabitant.

It is amusing enough to observe the patience and assiduity with which they labour. They carry out all the earth, grain by grain, to the mouth of the hole, where it forms a little hillock; an Alps, compared to the power of the artist by which it is raised. Sometimes the walks of a garden are found undermined by their labours; some of the holes running directly downward, others horizontally beneath the surface. They

the circumference to the centre, and she produces a shelf, united with such care with her natural glue, that a number of fragments are as solid as one piece.

"The violet carpenter-bee, as may be expected, occupies several weeks in these complicated labours; and during that period she is gradually depositing her eggs, each of which is successively to become a grub, a pupa, and a perfect bee. It is obvious, therefore, as she does not lay all her eggs in the same place—as each is separated from the other by a laborious process—that the egg which is first laid will be the earliest hatched; and that the first perfect insect, being older than its fellows in the same tunnel, will strive to make its escape sooner, and so on of the rest. The careful mother provides for this contingency. She makes a lateral opening at the bottom of the cells; for the teeth of the young bees would not be strong enough to pierce the outer wood, though they can remove the cemented rings of sawdust in the interior. Reaumur observed these holes, in several cases; and he further noticed another external opening opposite to the middle cell, which he supposed was formed, in the first instance, to shorten the distance for the removal of the fragments of wood in the lower half of the building."—*Insect Architecture*.

lay up in these cavities provisions for their young, which consist of a paste that has the appearance of corn, and is of a sweetish taste.

The Leaf-cutting bees make their nest and lay their eggs among bits of leaves, very artificially placed in holes in the earth, of about the length of a tooth-pick case. They make the bits of leaves of a roundish form, and with them line the inside of their habitations. This tapestry is still further lined by a reddish kind of paste, somewhat sweet or acid. These bees are of various kinds; those that build their nests with chestnut leaves are as big as drones, but those of the rose-tree are smaller than the common bee.⁵

The Wall-bees are so called because they make their nests in walls, of a kind of silky membrane with which they fill up the vacuities between the small stones which form the sides of their habitation. Their apartment consists of several cells placed end to end, each in the shape of a woman's thimble. Though the web which lines

⁵ A species of the leaf-cutting bee is called the *poppy-bee*, from its selecting the scarlet petals of the poppy as tapestry for its cells. Kirby and Spence express their doubts whether it is indigenous to this country: but Mr. Rennie is almost certain that he saw the nests in Scotland. "At Largs, in Ayrshire," he says, "a beautiful sea-bathing village on the Firth of Clyde, in July 1814, we found in a foot-path a great number of the cylindrical perforations of the poppy-bee. Reaumur remarked that the cells of this bee which he found at Bercy, were situated in a northern exposure, contrary to what he had remarked in the mason-bee, which prefers the south. The cells at Largs, however, were on an elevated bank, facing the south, near Sir Thomas Brisbane's observatory. With respect to exposure, indeed, no certain rule seems applicable; for the nests of mason-bees which we found on the wall of Greenwich-park faced the north-east, and we have often found carpenter-bees make choice of a similar situation."

"It will, perhaps, be impossible ever to ascertain, beyond a doubt," continues Mr. Rennie, "whether the tapestry-bee is led to select the brilliant petals of the poppy from their colour, or from any other quality they may possess, of softness, or of warmth, for instance. Reaumur thinks that the largeness, united with the flexibility of the poppy-leaves, determines her choice. Yet it is not improbable that her eye may be gratified by the appearance of her nest;—that she may possess a feeling of the beautiful in colour, and may look with complacency upon the delicate hangings of the apartment which she destines for her offspring. Why should not an insect be supposed to have a glimmering of the value of ornament? How can we pronounce, from our limited notion of the mode in which the inferior animals think and act, that their gratifications are wholly bounded by the positive utility of the objects which surround them? Why does a dog howl at the sound of a bugle, but because it offends his organs of hearing?—and why, therefore, may not a bee feel gladness in the brilliant hues of her scarlet drapery, because they are grateful to her organs of sight? All these little creatures work, probably, with more neatness and finish than is absolutely essential for comfort; and this circumstance alone would imply that they have something of taste to exhibit, which produces to them a pleasurable emotion."—Ed.

this habitation is thick and warm, yet it is transparent, and of a whitish colour. This substance is supposed to be spun from the animal's body. The males and females are of a size, but the former are without a sting.—To these varieties of the bee kind might be added several others, which are all different in their nature, but not sufficiently distinguished to excite curiosity.⁶

CHAP. III.

OF THE WASP.

HOWEVER similar many insects may be in appearance, this does not imply a similitude in their history. The bee and the wasp resemble each other very strongly, yet, in examining their manner and their duration, they differ very widely: the bee labours to lay up honey, and lives to enjoy the fruits of its industry: the wasp appears equally assiduous; but only works for posterity, as the habitation is scarcely completed when the inhabitant dies.

The wasp is well known to be a winged insect with a sting; to be longer in proportion to its bulk than the bee, to be marked with bright yellow circles round its body, and to be the most swift and active insect of all the fly kind. On each side of the mouth this animal is furnished with a long tooth, notched like a saw, and with these it is enabled to cut any substance, not omitting meat itself, and to carry it to its nest. Wasps live, like bees, in community, and sometimes ten or twelve thousand are found inhabiting a single nest.

Of all other insects the wasp is the most fierce, voracious, and most dangerous, when enraged. They are seen wherever flesh is cutting up, gorging themselves with the spoil, and then flying to their nests with their reeking prey. They make war also on every other fly, and the spider himself dreads their approaches.

Every community among bees is composed of females, or queens, drones or males, and neutral or working bees. Wasps have similar occupations; the two first are for propagating the species, the last for nursing, defending, and supporting the rising progeny. Among bees, however, there is seldom above a queen or two in a hive; among wasps there are above two or three hundred.

As soon as the summer begins to invigorate the insect tribes, the wasps are the most of the number, and diligently employed either in providing provisions for their nest, if already made; or in making one, if the former habitation be

too small to receive the increasing community. The nest is one of the most curious objects in natural history, and contrived almost as artificially as that of the bees themselves. Their principal care is to seek out a hole that has been begun by some other animal, a field-mouse, a rat, or a mole, to build their nests in. They sometimes build upon the plain, where they are sure of the dryness of their situation; but most commonly on the side of a bank, to avoid the rain or water that would otherwise annoy them. When they have chosen a proper place, they go to work with wonderful assiduity. Their first labour is to enlarge and widen the hole, taking away the earth, and carrying it off to some distance. They are perfectly formed for labour, being furnished with a trunk above their mouths, two saws on each side, which play to the right and left against each other, and six strong muscular legs to support them. They cut the earth into small parcels with their saws, and carry it out with their legs or paws. This is the work of some days; and at length the outline of their habitation is formed, making a cavity of about a foot and a half every way. While some are working in this manner, others are roving the fields to seek out materials for their building. To prevent the earth from falling down and crushing their rising city into ruin, they make a sort of roof with their gluey substance, to which they begin to fix the rudiments of their building, working from the top downwards, as if they were hanging a bell; which, however, at length they close up at the bottom. The materials with which they build their nests are bits of wood and glue. The wood they get where they can from the rails and posts which they meet with in the fields and elsewhere. These they saw and divide into a multitude of small fibres, of which they take up little bundles in their claws, letting fall upon them a few drops of gluey matter, with which their bodies are provided, by the help of which they knead the whole composition into a paste, which serves them in their future building. When they have returned with this to the nest, they stick their load of paste on that part where they make their walls and partitions; they tread it close with their feet, and trowl it with their trunks, still going backwards as they work. Having repeated this operation three or four times, the composition is at length flatted out until it becomes a small leaf of a gray colour, much finer than paper, and of a pretty firm texture.¹ This done, the same wasp returns to the

⁶ The Rev. Mr. Kirby has discovered no less than two hundred and twenty-one distinct species of bees. He divides the Linnæan genus into *mellita* and *apis*, distinguishing them by their tongues; the insects of the first having short flattish inflected tongues.—ED.

¹ "The wasp is a paper-maker, and a most perfect and intelligent one. While mankind were arriving by slow degrees, at the art of fabricating this valuable substance, the wasp was making it before their eyes, by very much the same process as that by which human hands now manufacture it with the best aid of chemistry and machinery. While some nations carved their records on wood, and stone, and brass, and leaden tablets,—others, more advanced, wrote with a style on wax,—others employed the

field to collect a second load of paste, repeating the same several times, placing layer upon layer, and strengthening every partition in proportion to the wants or convenience of the general fabric.

inner bark of trees, and others the skins of animals rudely prepared,—the wasp was manufacturing a firm and durable paper. Even when the papyrus was rendered more fit, by a process of art, for the transmission of ideas in writing, the wasp was a better artisan than the Egyptians; for the early attempts at paper-making were so rude, that the substance produced was almost useless, from being extremely friable. The paper of the papyrus was formed of the leaves of the plant, dried, pressed, and polished; the wasp alone knew how to reduce vegetable fibres to a pulp, and then unite them by a size or glue, spreading the substance out into a smooth and delicate leaf. This is exactly the process of paper-making. It would seem that the wasp knows, as the modern paper-makers now know, that the fibres of rags, whether linen or cotton, are not the only materials that can be used in the formation of paper; she employs other vegetable matters, converting them into a proper consistency by her assiduous exertions. In some respects she is more skilful even than our paper-makers, for she takes care to retain her fibres of sufficient length, by which she renders her paper as strong as she requires. Many manufacturers of the present day cut their material into small bits, and thus produce a rotten article. One great distinction between good and bad paper is its toughness; and this difference is invariably produced by the fibre of which it is composed being long, and therefore tough; or short, and therefore friable. The wasp has been labouring at her manufacture of paper, from her first creation, with precisely the same instruments and the same materials; and her success has been unvarying. Her machinery is very simple, and therefore it is never out of order. She learns nothing, and she forgets nothing. Men, from time to time, lose their excellence in particular arts, and they are slow in finding out real improvements. Such improvements are often the effect of accident. Paper is now manufactured very extensively by machinery, in all its stages; and thus, instead of a single sheet being made by hand, a stream of paper is poured out, which would form a roll large enough to extend round the globe, if such a length were desirable. The inventors of this machinery, Messrs. Fourdrinier, it is said, spent the enormous sum of £40,000 in vain attempts to render the machine capable of determining with precision the width of the roll; and, at last, accomplished their object, at the suggestion of a bystander, by a strap revolving upon an axis, at a cost of three shillings and sixpence. Such is the difference between the workings of human knowledge and experience, and those of animal instinct. We proceed slowly and in the dark—but our course is not bounded by a narrow line, for it seems difficult to say what is the perfection of any art; animals go clearly to a given point—but they can go no further. We may, however, learn something from their perfect knowledge of what is within their range. It is not improbable that if man had attended in an earlier state of society to the labours of wasps, he would have sooner known how to make paper. We are still behind in our arts and sciences, because we have not always been observers. If we had watched the operations of insects, and the structure of animals in general, with more care, we might have been far advanced in the knowledge of many arts, which are yet in their infancy, for nature has given us abundance of patterns. We have learned to perfect some instruments of sound by examining the structure of the human ear; and the mechanism of an eye has sug-

Other working wasps come quickly after to repeat the same operation, laying more leaves upon the former, till at length, after much toil, they have finished the large roof, which is to secure them from the tumbling in of the earth. This dome being finished, they make another entrance to their habitation, designed either for letting in the warmth of the sun, or for escaping, in case one door be invaded by plunderers. Certain however, it is, that by one of these they always enter, by the other they sally forth to their toil; each hole being so small that they can pass but one at a time. The walls being thus composed, and the whole somewhat of the shape of a pear, they labour at their cells, which they compose of the same paper-like substance that goes to the formation of the outside works. Their combs differ from those of bees not less in the composition than the position which they are always seen to obtain. The honey-comb of the bee is edgeways with respect to the hive; that of the wasp is flat, and the mouth of every cell opens downwards. Thus is their habitation contrived, story above story, supported by several rows of pillars, which give firmness to the whole building, while the upper story is flat-roofed, and as smooth as the pavement of a room, laid with squares of marble. The wasps can freely walk upon these stories between the pillars to do whatever their wants require. The pillars are very hard and compact, being larger at each end than in the middle, not much unlike the columns of a building. All the cells of the nest are only destined for the reception of the young, being replete with neither wax nor honey.

Each cell is like that of the bee, hexagonal: but they are of two sorts; the one larger, for the production of the male and female wasps; the other less, for the reception of the working part of the community. When the females are impregnated by the males, they lay their eggs, one in each cell, and stick it in with a kind of gummy matter to prevent its falling out. From this egg proceeds the insect in its worm state, of which the old ones are extremely careful, feeding it from time to time till it becomes large, and entirely fills up its cell. But the wasp community differs from that of the bee in this; that among the latter the working bees take the parental duties upon them, whereas among the wasps the females alone are permitted to feed their young, and to nurse their rising progeny. For this purpose the female waits with great patience till the working wasps have brought in their provisions, which she takes from them, and cuts into pieces. She then goes with great composure from cell to cell, and feeds every young one with her mouth. When the young worms have come to a certain size they leave off eating, and begin to spin a very fine silk, fixing their

gested some valuable improvements in achromatic glasses."—*Rennie's Insect Architecture*.

first end to the entrance of the cell; then turning their heads, first on one side, then on the other, they fix the thread to different parts, and thus they make a sort of door, which serves to close up the mouth of the cell. After this they divest themselves of their skins after the usual mode of transformation; the aurelia, by degrees, begins to emancipate itself from its shell; by little and little it thrusts out its legs and wings, and insensibly acquires the colour and shape of its parent.

The wasp thus formed, and prepared for depredation, becomes a bold, troublesome, and dangerous insect: there are no dangers which it will not encounter in pursuit of its prey, and nothing seems to satiate its gluttony. Though it can gather no honey of its own, no animal is more fond of sweets. For this purpose it will pursue the bee and the humble-bee, destroy them with its sting, and then plunder them of their honey-bag, with which it flies triumphantly loaded to its nest to regale its young. Wasps are ever fond of making their nests in the neighbourhood of bees, merely to have an opportunity of robbing their hives, and feasting on the spoil. Yet the bees are not found always patiently submissive to their tyranny, but fierce battles are sometimes seen to ensue, in which the bees make up by conduct and numbers what they want in personal prowess. When there is no honey to be had, they seek for the best and sweetest fruits, and they are never mistaken in their choice. From the garden they fly to the city, to the grocers' shops, and butchers' shambles. They will sometimes carry off bits of flesh half as big as themselves, with which they fly to their nests for the nourishment of their brood. Those who cannot drive them away, lay for them a piece of ox's liver, which being without fibres, they prefer to other flesh; and whenever they are found, all other flies are seen to desert the place immediately. Such is the dread with which these little animals impress all the rest of the insect tribes, which they seize and devour without mercy, that they vanish at their approach. Wherever they fly, like the eagle or the falcon, they form a desert in the air around them. In this manner the summer is passed in plundering the neighbourhood, and rearing up their young: every day adds to their numbers; and from their strength, agility, and indiscriminate appetite for every kind of provision, were they as long-lived as the bee, they would soon swarm upon the face of nature, and become the most noxious plague of man; but providentially their lives are measured to their mischief, and they live but a single season.

While the summer heats continue, they are bold, voracious, and enterprising; but as the sun withdraws, it seems to rob them of their courage and activity. In proportion as the cold increases, they are seen to become more domestic; they seldom leave the nest; they make but short

adventures from home, they flutter about in the noon-day heats, and soon after return chilled and feeble.

As their calamities increase, new passions soon begin to take place; the care for posterity no longer continues; and as the parents are no longer able to provide their growing progeny a supply, they take the barbarous resolution of sacrificing them all to the necessity of the times. In this manner, like a garrison upon short allowance, all the useless hands are destroyed; the young worms, which a little before they fed and protected with so much assiduity, are now butchered, and dragged from their cells. As the cold increases, they no longer find sufficient warmth in their nests, which grow hateful to them, and they fly to seek it in the corners of houses, and places that receive an artificial heat. But the winter is still insupportable; and before the new year begins, they wither and die; the working-wasps first, the males soon following, and many of the females suffering in the general calamity. In every nest, however, one or two females survive the winter, and having been impregnated by the male during the preceding season, she begins in spring to lay her eggs in a little hole of her own contrivance. This bundle of eggs, which is clustered together like grapes, soon produces two worms, which the female takes proper precaution to defend and supply, and these, when hatched, soon give assistance to the female, who is employed in hatching two more; these also gathering strength, extricate themselves out of the web that enclosed them, and become likewise assistants to their mother; fifteen days after, two more make their appearance; thus is the community every day increasing, while the female lays in every cell, first a male and then a female. These soon after become breeders in turn, till, from a single female, ten thousand wasps are seen produced before the month of June. After the female has thus produced her progeny, which are distributed in different districts, they assemble from all parts in the middle of summer, and provide for themselves the large and commodious habitation which has been described above.²

² "One of the most remarkable of our native social wasps is the *Vespa Britannica*, or tree-wasp, which is not uncommon in the northern, but seldom to be met with in the southern parts of the island. Instead of burrowing in the ground like the common wasp, or in the hollows of trees like the hornet, it boldly swings its nest from the extremity of a branch, where it exhibits some resemblance, in size and colour, to a Welsh wig, hung out to dry. We have seen more than one of these nests on the same tree, at Catrine, in Ayrshire, and at Wemyss Bay, in Renfrewshire. The tree which the *Britannica* wasp prefers is the silver fir, whose broad flat branch serves as a protection to the suspended nest both from the sun and the rain. The materials and structure are nearly the same as those employed by the common wasp, and which we have already described." —Professor Rennie.

Such is the history of the social wasp; but, as among bees, so also among these insects, there are various tribes that live in solitude; these lay their eggs in a hole for the purpose, and the parent dies long before the birth of its offspring. In the principal species of the Solitary-wasps, the insect is smaller than the working-wasp of the social kind. The filament by which the corselet is joined to the body, is longer and more distinctly seen, and the whole colour of the insect is blacker than in the ordinary kinds. But it is not their figure, but the manners of this extraordinary insect, that claim our principal regard.

From the end of May to the beginning of July this wasp is seen most diligently employed. The whole purpose of its life seems to be in contriving and fitting up a commodious apartment for its young one, which is not to succeed it till the year ensuing. For this end it is employed, with unwearied assiduity, in boring a hole in the finest earth some inches deep, but not much wider than the diameter of its own body. This is but a gallery leading to a wider apartment destined for the convenient lodgment of its young. As it always chooses a gravelly soil to work in, and where the earth is almost as hard as stone itself, the digging and hollowing this apartment is an enterprise of no small labour: for effecting its operations, this insect is furnished with two teeth, which are strong and firm, but not sufficiently hard to penetrate the substance through which it is resolved to make its way. In order therefore to soften that earth which it is unable to pierce, it is furnished with a gummy liquor, which it emits upon the place, and which renders it more easily separable from the rest, and the whole becoming a kind of soft paste, is removed to the mouth of the habitation. The animal's provision of liquor in these operations is, however, soon exhausted; and it is then seen taking up water either from some neighbouring flower or stream, in order to supply the deficiency.

At length, after much toil, a hole some inches deep is formed, at the bottom of which is a large cavity; and to this no other hostile insect would venture to find its way, from the length and the narrowness of the defile through which it would be obliged to pass. In this the solitary wasp lays its egg, which is destined to continue the species; there the nascent animal is to continue for about nine months unattended and immured, and at first appearance the most helpless insect of the creation. But when we come to examine, new wonders offer; no other insect can boast so copiously luxurious a provision, or such confirmed security.

As soon as the mother wasp has deposited her egg at the bottom of the hole, her next care is to furnish it with a supply of provisions, which may be offered to the young insect as soon as it leaves the egg. To this end she procures a number of little green worms, generally from eight to twelve,

and these are to serve as food for the young one the instant it awakens into life. When this supply is regularly arranged and laid in, the old one then, with as much assiduity as it before worked out its hole, now closes the mouth of the passage; and thus leaving its young one immured in perfect security, and in a copious supply of animal food, she dies, satisfied with having provided for a future progeny.

When the young one leaves the egg, it is scarcely visible, and is seen immured among a number of insects, infinitely larger than itself, ranged in proper order around it, which, however, give it no manner of apprehension. Whether the parent, when she laid in the insect provision, contrived to disable the worms from resistance, or whether they were at first incapable of any, is not known. Certain it is, that the young glutton feasts upon the living spoil without any control; his game lies at his hand, and he devours one after the other as the calls of appetite incite him. The life of the young animal is therefore spent in the most luxuriant manner, till its whole stock of worms is exhausted, when the time of its transformation begins to approach; and then spinning a silken web, it continues fixed in its cell till the sun calls it from its dark abode the ensuing summer.

The wasps of Europe are very mischievous, yet they are innocence itself when compared to those of the tropical climates, where all the insect tribes are not only numerous but large, voracious, and formidable. Those of the West Indies are thicker, and twice as long, as the common bee; they are of a gray colour, striped with yellow, and armed with a very dangerous sting. They make their cells in the manner of a honeycomb, in which the young ones are hatched and bred. They generally hang their nests by threads, composed of the same substance with the cells, to the branches of trees, and the eaves of houses. They are seen everywhere in great abundance, descending like fruit, particularly pears, of which shape they are, and as large as one's head. The inside is divided into three round stories full of cells, each hexagonal, like those of a honeycomb. In some of the islands these insects are so very numerous, that their nests are stuck up in this manner, scarce two feet asunder, and the inhabitants are in continual apprehension from their accidental resentment. It sometimes happens that no precautions can prevent their attacks, and the pain of their sting is almost insupportable. Those who have felt it, think it more terrible than even that of a scorpion; the whole visage swells, and the features are so disfigured, that a person is scarcely known by his most intimate acquaintance.

SUPPLEMENTARY NOTE.

The *Hornet* is an insect of a large size. The thorax is black, the fore-part rufous. The extremity of the abdomen is yellow, with three black points

on each segment. It is chiefly in the hollow trunks of decayed trees that the hornets form their nest. They live collected together in communities, which consist of males, females, and neuters or labourers. Their nest is of a dirty yellow colour, and usually constructed under the shelter of some out-house, in the hole of an old wall, or more frequently in the hollow trunk of some decayed tree. The hole of entrance to this nest is oftentimes not more than an inch in diameter. In the spring of the year, those of the females which have survived the winter are reanimated by the warmth of the season, issue from their hiding-places, and search out a convenient place on which they can establish their nest. When this is found, they commence their first operation by forming a column, of the same materials as those which are afterwards employed in the other parts of the fabric, but much more compact and solid. A kind of cover is next formed, and then a small comb of hexagonal cells, with their openings downward, for the purpose of containing their eggs and the grubs which issue from them. The eggs are soon hatched, and the mother nourishes her offspring with food which she brings to them from abroad. When the grubs have attained their full size they each spin a silken bed, in which they undergo their metamorphoses into *pupæ*, and afterwards into perfect and winged insects. Those first produced are the neuters. These are working insects, or labourers; that is to say, they are from this period occupied in the work of constructing, and in the duty of nourishing the remaining grubs. The females still continuing to lay, the family is consequently augmented; and the nest becoming now too small, necessity requires it to be enlarged. This operation falls wholly upon the labourers.

CHAP. IV.

OF THE ICHNEUMON-FLY.

EVERY rank of insects, how voracious soever, have enemies that are terrible to them, and that revenge upon them the injuries done upon the rest of the animated creation. The wasp, as we have seen, is very troublesome to man, and very formidable to the insect tribe; but the ichneumon-fly (of which there are many varieties) fears not the wasp itself; it enters its retreats, plunders its habitations, and takes possession of that cell for its own young, which the wasp had laboriously built for a dearer posterity.

Though there are many different kinds of this insect, yet the most formidable, and that best known, is called the common ichneumon, with four wings, like the bee, a long, slender, black body, and a three-forked tail, consisting of bristles; the two outermost black, and the middlemost red. This fly receives its name from the little quadruped, which is found to be so destructive to the crocodile, as it bears a strong similitude in its courage and rapacity.

Though this instrument is, to all appearance, slender and feeble, yet it is found to be a weapon of great force and efficacy. There is scarcely any substance which it will not pierce; and indeed it is seldom seen but employed in penetration. This is the weapon of defence; this is employed

in destroying its prey; and still more, by this the animal deposits her eggs wherever she thinks fit to lay them. As it is an instrument chiefly employed for this purpose, the male is unprovided with such a sting, while the female uses it with great force and dexterity, brandishing it when caught, from side to side, and very often wounding those who thought they held her with the greatest security.

All the flies of this tribe are produced in the same manner, and owe their birth to the destruction of some other insect, within whose body they have been deposited, and upon whose vitals they have preyed, till they came to maturity. There is no insect whatever, which they will not attack, in order to leave their fatal present in its body; the caterpillar, the gnat, and even the spider himself, so formidable to others, is often made the unwilling fosterer of this destructive progeny.

About the middle of the summer, when other insects are found in great abundance, the ichneumon is seen flying busily about, and seeking proper objects upon whom to deposit its progeny. As there are various kinds of this fly, so they seem to have various appetites. Some are found to place their eggs within the aurelia of some nascent insect, others place them within the nest which the wasp had curiously contrived for its own young: and as both are produced at the same time, the young of the ichneumon not only devours the young wasp, but the whole supply of worms which the parent had carefully provided for its provision. But the greatest number of the ichneumon tribe are seen settling upon the back of the caterpillar, and darting, at different intervals, their stings into its body. At every dart they deposit an egg, while the wounded animal seems scarcely sensible of the injury it sustains. In this manner they leave from six to a dozen of their eggs within the fatty substance of the reptile's body, and then fly off to commit further depredations. In the meantime, the caterpillar, thus irreparably injured, seems to feed as voraciously as before; does not abate of its usual activity; and, to all appearance, seems no way affected by the internal enemies that are preparing its destruction in their darksome abode. But they soon burst from their egg state, and begin to prey upon the substance of their prison. As they grow larger, they require a greater supply; till at last the animal, by whose vitals they are supported, is no longer able to sustain them, but dies; its whole inside being almost eaten away. It often happens, however, that it survives their worm-state, and then they change into a chrysalis, enclosed in the caterpillar's body till the time of their delivery approaches, when they burst their prisons, and fly away. The caterpillar, however, is irreparably destroyed, it never changes into a chrysalis, but dies shortly after from the injuries it had sustained.

Such is the history of this fly, which, though

very terrible to the insect tribe, fails not to be of infinite service to mankind. The millions which it kills in a single summer are inconceivable; and without such a destroyer, the fruits of the earth would only rise to furnish a banquet for the insect race, to the exclusion of all the nobler ranks of animated nature.

CHAP. V.

OF THE ANT.

Though the number of two-winged flies be very great, and the naturalists have taken much pains to describe their characters and varieties, yet there is such a similitude in their forms and manners, that in a work like this, one description must serve for all. We now, therefore, come to a species of four-winged insects, that are famous from all antiquity for their social and industrious habits, that are marked for their spirit of subordination, that are offered as a pattern of parsimony to the profuse, and of unremitting diligence to the sluggard.

In the experiments, however, which have been more recently made, and the observations which have been taken, much of their boasted frugality and precaution seems denied them: the treasures they lay up are no longer supposed intended for future provision; and the choice they make in their stores seems no way dictated by wisdom. It is indeed somewhat surprising, that almost every writer of antiquity should describe this insect, as labouring in the summer, and feasting upon the produce during the winter. Perhaps, in some of the warmer climates, where the winter is mild, and of short continuance, this may take place; but in France and England, these animals can have no manner of occasion for a supply of winter provision, as they are actually in a state of torpidity during that season.

The common ants of Europe are of two or three different kinds: some red, some black; some with stings, and others without; such as have stings inflict their wounds in that manner; such as are unprovided with these weapons of defence, have a power of spurting from their hinder parts an acid pungent liquor, which, if it lights upon the skin, inflames and burns it like nettles.

The body of an ant is divided into the head, breast, and belly. In the head the eyes are placed, which are entirely black, and under their eyes there are two small horns or feelers, composed of twelve joints, all covered with a fine silky hair. The mouth is furnished with two crooked jaws, which project outwards, in each of which are seen incisors, that look like teeth. The breast is covered with a fine silky hair, from which project six legs, that are pretty strong and hairy, the extremities of each armed with two small claws, which the animal uses in climbing.

The belly is more reddish than the rest of the body, which is of a brown chestnut colour, shining as glass, and covered with extremely fine hair.

From such a formation, this animal seems bolder and more active, for its size, than any other of the insect tribe, and fears not to attack a creature often above ten times its own magnitude.

As soon as the winter is past, in the first fine day in April, the ant-hill, that before seemed a desert, now swarms with new life, and myriads of these insects are seen just awaked from their annual lethargy, and preparing for the pleasures and fatigues of the season. For the first day they never offer to leave the hill, which may be considered as their citadel, but run over every part of it, as if to examine its present situation, to observe what injuries it has sustained during the rigours of winter,¹ while they slept, and to meditate and settle the labours of the day ensuing.

At the first display of their forces, none but the wingless tribe appears, while those furnished with wings remain at the bottom. These are the working ants that first appear, and that are always destitute of wings; the males and females, that are furnished with four large wings each, are more slow in making their appearance.

Thus, like bees, they are divided into males, females, and the neutral or the working tribe. These are all easily distinguished from each other: the females are much larger than the males; the working ants are the smallest of all. The two former have wings; which, however, they sometimes are divested of; the latter never have any, and upon them are devolved all the labours that tend to the welfare of the community. The female, also, may be distinguished by the colour and structure of her breast, which is a little more brown than that of the common ant, and a little brighter than that of the male.

In eight or ten days after their first appearance, the labours of the hill are in some forwardness; the males and females are seen mixed with the working multitude, and pursued or pursuing each other. They seem no way to partake in the common drudgeries of the state; the males pursue the females with great assiduity, and in a manner force them to compliance. They remain coupled for some time; while the males, thus united, suffer themselves to be drawn along by the will of their partners.

In the meantime, the working body of the state take no part in their pleasures; they are seen diligently going from the ant-hill in pursuit of food for themselves and their associates, and of proper materials for giving a comfortable retreat to their young, or safety to their habitation. In the fields of England, ant-hills are

¹ *Memoires pour servir a l'Histoire des Insectes par Charles de Geer.*

formed with but little apparent regularity. In the more southern provinces of Europe, they are constructed with wonderful contrivance, and offer a sight highly worthy a naturalist's curiosity. These are generally formed in the neighbourhood of some large tree and a stream of water. The one is considered by the animals as the proper place for getting food; the other for supplying them with moisture, which they cannot well dispense with. The shape of an ant-hill is that of a sugar-loaf, about three feet high, composed of various substances; leaves, bits of wood, sand, earth, bits of gum, and grains of corn. These are all united into a compact body, perforated with galleries down to the bottom, and winding ways within the body of the structure. From this retreat, to the water, as well as to the tree, in different directions, there are many paths worn by constant assiduity, and along these the busy insects are seen passing and repassing continually; so that from May or the beginning of June, according to the state of the season, they work continually, till the bad weather comes on.

The chief employment of the working ants, is in sustaining not only the idlers at home, but also finding a sufficiency of food for themselves. They live upon various provisions, as well of the vegetable as of the animal kind. Small insects they will kill and devour; sweets of all kinds they are particularly fond of. They seldom however think of their community, till they themselves are first satiated. Having found a juicy fruit, they swallow what they can, and then tearing it in pieces, they carry home their load. If they meet with an insect above their match, several of them will fall upon it at once, and, having mangled it, each will carry off a part of the spoil. If they meet, in their excursions, any thing that is too heavy for one to bear, and yet which they are unable to divide, several of them will endeavour to force it along, some dragging and others pushing. If one of them happens to make a lucky discovery, it will immediately give advice to others, and then, at once, the whole republic will put themselves in motion. If in these struggles one of them happens to be killed, some kind survivor will carry it off to a great distance, to prevent the obstructions his body might give to the general spirit of industry.²

² M. Hanhart gives an account of a battle which he witnessed between two species of these insects—one the *Formica rufa*, and the other a little black ant. He saw them approach in armies composed of their respective swarms, and advancing towards each other in the greatest order. The *Formica rufa* marched with one in front, on a line from nine to twelve feet in length, flanked by several corps in square masses, composed of from twenty to sixty individuals. The second species (little blacks), forming an army much more numerous, marched to meet the enemy on a very extended line, and from one to three individuals abreast. They left a detachment at the foot of their hillock to defend it against any unlooked-for attack. The rest of the

But while they are thus employed in supporting the state in feeding abroad, and carrying in provisions to those that continue at home, they are not unmindful of posterity. After a few days of fine weather, the female ants begin to lay their eggs, and those are as assiduously watched and protected by the working ants, who take upon themselves to supply whatever is wanting to the nascent animal's convenience or necessity. They are carried, as soon as laid, to the safest situation, at the bottom of their hill, where they are carefully defended from cold and moisture. We are not to suppose, that those white substances which we so plentifully find in every ant-hill, are the eggs as newly laid. On the contrary, the ant's egg is so very small, that, though laid upon a black ground, it can scarcely be discerned. The little white bodies we see are the young animals in their maggot state, long since freed from the egg, and often involved in a cone, which it has spun round itself, like the silkworm. The real egg when laid, if viewed through a microscope, appears smooth, polished, and shining, while the maggot is seen composed of twelve rings, and is often larger than the ant itself.—It is impossible to express the fond attachment which the working ants show to their rising progeny. In cold weather they take them in their mouths, but without offering them the smallest injury, to the very depths of their habitation, where they are less subject to the severity of the season. In a fine day they remove them with the same care nearer the surface, where their maturity may be assisted by the warm beams of the sun. If a formidable enemy should come to batter down their whole habitation, and crush

army marched to battle, with its right wing supported by a solid corps of several hundred individuals, and the left wing supported by a similar body of more than a thousand. These groups advanced in the greatest order, and without changing their positions. The two lateral corps took no part in the principal action. That of the right wing made a halt and formed an army of reserve; whilst the corps which marched in column on the left wing manœuvred so as to turn the hostile army, and advanced with a hurried march to the hillock of the *Formica rufa*, and took it by assault. The two armies attacked each other and fought for a long time without breaking their lines. At length disorder appeared in various points, and the combat was maintained in detached groups; and after a bloody battle, which continued from three to four hours, the *Formica rufa* were put to flight, and forced to abandon their two hillocks, and go off to establish themselves at some other point with the remains of their army. The most interesting part of this exhibition, says M. Hanhart, was to see these insects reciprocally making prisoners, and transporting their own wounded to their hillocks. Their devotedness to the wounded was carried so far, that the *Formica rufa*, in conveying them to their nests, allowed themselves to be killed by the little blacks without offering any resistance, rather than abandon their precious charge. From the observations of M. Huber, it is known that when an ant-hillock is taken by the enemy, the vanquished are reduced to slavery, and employed in the interior labours of their habitation.—Ed.

them by thousands in the ruin, yet these wonderful insects, still mindful of their parental duties, make it their first care to save their offspring. They are seen running wildly about, and in different ways, each loaded with a young one, often bigger than the insect that supports it. I have kept, says Swammerdam, several of the working ants in my closet, with their young in a glass filled with earth. I took pleasure in observing, that in proportion as the earth dried on the surface, they dug deeper and deeper to deposit their eggs; and when I poured water thereon, it was surprising to see with what care, affection, and diligence, they laboured, to put their brood in safety, in the driest place. I have seen also, that when water has been wanting for several days, and when the earth was moistened after it a little, they immediately carried their young ones to have a share, who seemed to enjoy and suck the moisture.

When the young maggot has come to its full growth, the breast swells insensibly, it casts its skin, and loses all motion. All the members which were hidden before, then begin to appear; an aurelia is formed, which represents very distinctly all the parts of the animal, though they are yet without motion, and, as it were, wrapped up in swaddling clothes. When at length the little insect has passed through all its changes, and acquired its proper maturity, it bursts this last skin, to assume the form it is to retain ever after. Yet this is not done by the efforts of the little animal alone, for the old ones very assiduously break open with their teeth, the covering in which it is enclosed. Without this assistance the aurelia would never be able to get free, as M. de Geer often found, who tried the experiment by leaving the aurelias to themselves. The old ones not only assist them, but know the very precise time for lending their assistance; for, if produced too soon, the young one dies of cold; if retarded too long, it is suffocated in its prison.

When the female has done laying, and the whole brood is thus produced, her labour, as well as that of the male, becomes unnecessary; and her wings, which she had but a short time before so actively employed, drop off. What becomes of her when thus divested of her ornaments is not well known, for she is seen in the cells for some weeks after. The males, on the other hand, having no longer any occupation at home, make use of those wings with which they have been furnished by nature, and fly away, never to return or be heard of more. It is probable they perish with the cold, or are devoured by the birds, who are particularly fond of this petty prey.

In the meantime, the working-ants, having probably deposed their queens, and being deserted by the males, that served but to clog the community, prepare for the severity of the winter, and bury their retreats as deep in the earth as they conveniently can. It is now found that the

grains of corn, and other substances with which they furnish their hill, are only meant as fences to keep off the rigours of the weather, not as provisions to support them during its continuance. It is found generally to obtain, that every insect that lives a year after it has come to its full growth, is obliged to pass four or five months without taking any nourishment, and will seem to be dead all that time. It would be to no purpose, therefore, for ants to lay up corn for the winter, since they lie that time without motion, heaped upon each other, and are so far from eating, that they are utterly unable to stir. Thus, what authors have dignified by the name of a magazine, appears to be no more than a cavity, which serves for a common retreat when the weather forces them to return to their lethargic state.

What has been said with exaggeration of the European ant, is however true, if asserted of those of the tropical climates. They build an ant-hill with great contrivance and regularity, they lay up provisions, and as they probably live the whole year, they submit themselves to regulations entirely unknown among the ants of Europe.

Those of Africa are of three kinds, the red, the green, and the black; the latter are above an inch long, and in every respect a most formidable insect. Their sting produces extreme pain, and their depredations are sometimes extremely destructive. They build an ant-hill of a very great size, from six to twelve feet high; it is made of viscous clay, and tapers into a pyramidal form. This habitation is constructed with great artifice; and the cells are so numerous and even, that a honey-comb scarce exceeds them in number and regularity.

The inhabitants of this edifice seem to be under a very strict regulation. At the slightest warning they will sally out upon whatever disturbs them; and if they have time to arrest their enemy, he is sure to find no mercy. Sheep, hens, and even rats, are often destroyed by these merciless insects, and their flesh devoured to the bone. No anatomist in the world can strip a skeleton so completely as they; and no animal, how strong soever, when they have once seized upon it, has power to resist them.

It often happens that these insects quit their retreat in a body, and go in quest of adventures. "During my stay," says Smith, "at Cape Corse Castle, a body of these ants came to pay us a visit in our fortification. It was about daybreak when the advanced guard of this famished crew entered the chapel, where some negro servants were asleep on the floor. The men were quickly alarmed at the invasion of this unexpected army, and prepared, as well as they could, for a defence. While the foremost battalion of insects had already taken possession of the place, the rear-guard was more than a quarter of a mile distant. The whole ground seemed alive, and crawling

with unceasing destruction. After deliberating a few moments upon what was to be done, it was resolved to lay a large train of gunpowder along the path they had taken: by this means, millions were blown to pieces; and the rear-guard perceiving the destruction of their leaders, thought proper instantly to return and make back to their original habitation."

The order which these ants observe, seems very extraordinary; whenever they sally forth, fifty or sixty larger than the rest are seen to head the band, and conduct them to their destined prey. If they have a fixed spot where their prey continues to resort, they then form a vaulted gallery, which is sometimes a quarter of a mile in length; and yet they will hollow it out in the space of ten or twelve hours.

SUPPLEMENTARY NOTE.

The *Formica rufa*, or Wood-ant, is the largest of our British ants. It is called the Hill-ant by Gould, the Fallow-ant by the English translator of Huber, and popularly the Pismire. It invariably lives in or near woods and forests. It may be readily distinguished from other ants by the dusky black colour of its head and hinder parts, and the rusty brown of its middle. The structures reared by this species are often of considerable magnitude, and bear no small resemblance to a rook's nest thrown upon the ground, bottom upwards. The exterior of the nest is composed of almost every transportable material which the colonists can find in their vicinity; but the greater portion consists of withered grass and short twigs of trees, piled up in apparent confusion, but with sufficient regularity to render the whole smooth, conical, and sloping towards the base, for the purpose, we may infer, of carrying off rain water. When within reach of a corn-field, they often also pick up grains of wheat, barley, or oats, and carry them to the nest as building materials, and not for food as was believed by the ancients. The coping which forms the exterior of the wood-ant's nest, though only a small portion of the structure, which consists of a great number of interior chambers and galleries, with funnel-shaped avenues leading to them, is one of the most essential parts, and we cannot follow a more delightful guide than the younger Huber, in detailing its formation.

"The labourers," he says, "of which the colony is composed, not only work continually on the outside of their nest, but, differing very essentially from other species, who willingly remain in the interior, sheltered from the sun, they prefer living in the open air, and do not hesitate to carry on, even in our presence, the greater part of their operations. To have an idea how the straw or stubble roof is formed, let us take a view of the ant-hill at its origin, when it is simply a cavity in the earth. Some of its future inhabitants are seen wandering about in search of materials fit for the exterior work, with which, though rather irregularly, they cover up the entrance; whilst others are employed in mixing the earth, thrown up in hollowing the interior, with fragments of wood and leaves, which are every moment brought in by their fellow-assistants; and this gives a certain consistence to the edifice, which increases in size daily. Our little architects leave here and there cavities, where they intend constructing the galleries which are to lead to the exterior, and as they remove in the morning the barriers placed at the entrance of their nest the preceding evening, the passages are kept open during the whole

time of its construction. We soon observed the roof to become convex; but we should be greatly deceived did we consider it solid. This roof is destined to include many apartments or stories. Having observed the motions of these little builders through a pane of glass, adjusted against one of their habitations, I am thence enabled to speak with some degree of certainty upon the manner in which they are constructed. I ascertained, that it is by excavating or mining the under portion of their edifice, that they form their spacious halls, low indeed, and of heavy construction, yet sufficiently convenient for the use to which they are appropriated, that of receiving, at certain hours of the day, the larvæ and pupæ. These halls have a free communication by galleries, made in the same manner. If the materials of which the ant-hill is composed were only interlaced, they would fall into a confused heap every time the ants attempted to bring them into regular order. This, however, is obviated by their tempering the earth with rain-water, which, afterwards hardened in the sun, so completely and effectually binds together the several substances, as to permit the removal of certain fragments from the ant-hill without any injury to the rest; it, moreover, strongly opposes the introduction of the rain. I never found, even after long and violent rains, the interior of the nest wetted to more than a quarter of an inch from the surface, provided it had not been previously out of repair, or deserted by its inhabitants. The ants are extremely well sheltered in their chambers, the largest of which is placed nearly in the centre of the building; it is much loftier than the rest, and traversed only by the beams that support the ceiling; it is in this spot that all the galleries terminate, and this forms, for the most part, their usual residence. As to the underground portion, it can only be seen when the ant-hill is placed against a declivity; all the interior may be then readily brought in view, by simply raising up the straw-roof. The subterranean residence consists of a range of apartments, excavated in the earth, taking a horizontal direction."

There is this remarkable difference in the nest of the wood-ants, that they do not construct a long covert way as if for concealment, as the yellow and the brown ants do. The wood-ants are not, like them, afraid of being surprised by enemies, at least during the day, when the whole colony is either foraging in the vicinity or employed on the exterior. But the proceedings of the wood-ants at night are well worthy of notice; and when M. Huber began to study their economy, he directed his entire attention to their night proceedings. "I remarked," says he, "that their habitations changed in appearance hourly, and that the diameter of those spacious avenues, where so many ants could freely pass each other during the day, was, as night approached, gradually lessened. The aperture, at length, totally disappeared, the dome was closed on all sides, and the ants retired to the bottom of their nest. In further noticing the apertures of these ant-hills, I fully ascertained the nature of the labour of its inhabitants, of which I could not before even guess the purport; for the surface of the nest presented such a constant scene of agitation, and so many insects were occupied in carrying materials in every direction, that the movement offered no other image than that of confusion. I saw then clearly that they were engaged in stopping up passages; and for this purpose, they at first brought forward little pieces of wood, which they deposited near the entrance of those avenues they wished to close; they placed them in the stubble; they then went to seek other twigs and fragments of wood, which they disposed above the first, but in a different direction, and appeared to choose pieces of less size in proportion as the work advanced. They, at length, brought in a

number of dried leaves, and other materials of an enlarged form, with which they covered the roof: an exact miniature of the art of our builders, when they form the covering of any building! Nature, indeed, seems everywhere to have anticipated the inventions of which we boast, and this is doubtless one of the most simple. Our little insects, now in safety in their nest, retire gradually to the interior before the last passages are closed, one or two only remain without, or concealed behind the doors on guard, whilst the rest either take their repose, or engage in different occupations in the most perfect security. I was impatient to know what took place in the morning upon these ant-hills, and therefore visited them at an early hour. I found them in the same state in which I had left them the preceding evening. A few ants were wandering about on the surface of the nest, some others issued from time to time from under the margin of their little roofs formed at the entrance of the galleries: others afterwards came forth, who began removing the wooden bars that blockaded the entrance, in which they readily succeeded. This labour occupied them several hours. The passages were at length free, and the materials with which they had been closed, scattered here and there over the ant-hill. Every day, morning and evening, during the fine weather, I was a witness to similar proceedings. On days of rain the doors of all the ant-hills remained closed. When the sky was cloudy in the morning, or rain was indicated, the ants, who seemed to be aware of it, opened but in part their several avenues, and immediately closed them when the rain commenced."

The galleries and chambers which are roofed in as thus described, are very similar to those of the mason-ants, being partly excavated in the earth, and partly built with the clay thence procured. It is in these they pass the night, and also the colder months of the winter, when they become torpid or nearly so, and of course require not the winter granaries of corn with which the ancients fabulously furnished them.

The *Carpenter-ants*, or ants that work in wood, perform much more extensive operations than any of the other carpenter-insects. Their only tools, like those of bees and wasps, are their jaws or mandibles; but though these may not appear so curiously constructed as the ovipositor file of the tree-hopper, or the rasp and saw of the saw-flies, they are no less efficient in the performance of what is required. Among the carpenter-ants the emmet or jet-ant holds the first rank, and is easily known by being rather less in size than the wood-ant, and by its fine shining black colour. It is less common in Britain than the others, though its colonies may occasionally be met with in the trunks of decaying oak or willow trees in hedges.

Among the foreign ants, we may mention a small *yellow ant* of South America, described by Dampier, which seems, from his account, to construct a nest of green leaves. "Their sting," he says, "is like a spark of fire; and they are so thick among the boughs in some places, that one shall be covered with them before he is aware. These creatures have nests on great trees, placed on the body between the limbs: some of their nests are as big as a bogshead. This is their winter habitation; for in the wet season they all repair to these their cities, where they preserve their eggs. In the dry season, when they leave their nests, they swarm all over the woodlands, for they never trouble the savannahs. Great paths, three or four inches broad, made by them, may be seen in the woods. They go out light, but bring home heavy loads on their backs, all of the same substance, and equal in size. I never observed any thing besides pieces of green leaves, so big that I could scarcely see the insect for his bur-

den; yet they would march stoutly, and so many were pressing forward that it was a very pretty sight, for the path looked perfectly green with them."

Ants observed in New South Wales, by the gentlemen in the expedition under Captain Cook, are still more interesting. "Some," we are told, "are as green as a leaf, and live upon trees, where they build their nests of various sizes, between that of a man's head and his fist. These nests are of a very curious structure: they are formed by bending down several of the leaves, each of which is as broad as a man's hand, and glueing the points of them together so as to form a purse. The viscous matter used for this purpose is an animal juice which nature has enabled them to elaborate. Another sort are quite black. Their habitations are the inside of the branches of a tree which they contrive to excavate, by working out the pith almost to the extremity of the slenderest twig, the tree at the same time flourishing as if it had no such inmate. A third kind we found nested in the root of a plant, which grows on the bark of trees in the manner of mistletoe, and which they had perforated for that use. This root is commonly as big as a large turnip, and sometimes much bigger. When we cut it we found it intersected by innumerable winding passages, all filled with these animals, by which, however, the vegetation of the plant did not appear to have suffered any injury. We never cut one of these roots that was not inhabited, though some were not bigger than a hazel-nut. The animals themselves are very small, not more than half as big as the common red ant in England. They had stings, but scarcely force enough to make them felt: they had, however, a power of tormenting us in an equal, if not in a greater degree; for the moment we handled the root, they swarmed from innumerable holes, and running about those parts of the body that were uncovered, produced a titillation more intolerable than pain, except it is increased to great violence."

The species called *Sugar-ants* in the West Indies are particularly destructive to the sugar-cane, as well as to lime, lemon, and orange-trees, by excavating their nests at the roots, and so loosening the earth that they are frequently uprooted and blown down by the winds. If this does not happen the roots are deprived of due nourishment, and the plants become sickly and die.

But the most extraordinary of ants is the *White-ants* or *Termites*, inhabiting the plains of East India, Africa, and South America. The tiny creatures to which we now claim attention are about a quarter of an inch in length, and hence do not equal in dimensions some species of ants, and twenty-five of them weigh about a grain, and yet they construct those wondrous edifices of which we are about to treat. The nests of one species are so numerous all over the island of Bananas, and the adjacent continent of Africa, that it is scarcely possible to stand upon any cleared and open space where one of these buildings is not to be seen within fifty paces, and frequently two or three are to be witnessed almost close to each other. In some parts near Senegal, as mentioned by Adanson, their number, magnitude, and closeness of situation, make them appear like the villages of the natives. Each of these communities consists of one male and one female, who are generally the common parents of the rest, and of three orders of insects, apparently of very different species, but really the same, which, together, compose great commonwealths,—or rather monarchies, if we may use the term. The different species of the genus resemble each other in form, in their manner of living, and in their good and bad qualities, but differ as much as birds in the manner of building their habitations or nests, and in the choice of the materials of which they compose them. There are

some species which build upon the surface of the ground, or part above and part beneath, and one or two species, perhaps more, which build on the stems and branches of trees, sometimes at a vast height. Of every species there are three orders: first, the working insects, which may be called *labourers*; next, the fighting ones, or *soldiers*, which do no kind of labour; and, last of all, the winged ones, or *perfect insects*, which are male or female, and capable of propagation. These neither labour nor toil, nor fight, being almost incapable of self-defence. These only, however, are capable of being elected kings and queens; and Nature has so ordered it, that these emigrate a few weeks after they are elevated to this state, to establish new kingdoms, or perish in a day.

These buildings derive their names from their appearance, which is that of little hills, more or less conical, generally much in the form of sugar loaves, and about ten or twelve feet in perpendicular height above the surface of the ground. These hills continue quite bare for some time; but in the second or third year, if not over-shaded by trees, become covered with grass and other plants, like the surrounding soil. The exterior of these buildings is one large shell, in the shape of a dome, large and strong enough to enclose and shelter the interior from the vicissitudes of the weather, and the inhabitants from the attacks of natural or accidental enemies. It is always, therefore, much stronger than the interior building, which accommodates the interesting community. The hills at first are one or two, a foot or more high. Soon after, at a little distance, while the former are increasing in height and size, others are raised, and increase in number, widening at the base, till the lower works are covered with these edifices, which are raised highest and largest in the middle, until the intervals between the different turrets being filled up, a larger dome is formed. The animals are not very curious or exact about these turrets, except in making them very solid and strong, and when, by their junction, the dome is completed, they take away the middle ones entirely, except the tops, which, joined together, make the crown of the cupola, and apply the clay to the internal works, or to additional erections. A notion of the strength of these hills may be obtained from the fact, that, when little more than half their height, it is the practice of the wild bulls to stand as sentinels upon them, whilst the rest of the herd is ruminating below. At their full height they are excellent places for outlook, and four men may be accommodated on the top of one of the hillocks.

As to the interior, the royal chamber, occupied by the king and queen, appears, in the apprehension of the whole community, to be of primary importance. It is situated as near the centre of the building as possible, and generally near the surface of the ground: it is almost invariably shaped like a half egg. In the infant state of the colony, this apartment is not above an inch in length, but with time increases to six or eight inches, or more, being always in proportion to the size of the queen. Its floor, perfectly horizontal, is in large hillocks, sometimes more than an inch thick of solid clay. The roof also, which is one solid and well turned arch, is generally about the same solidity; but, on the sides, where it joins the floor, is in some places not more than a quarter of an inch thick. Here are placed the doors, and these entrances will not admit any animal larger than the soldiers and labourers; so that the king and queen can never possibly go out. The royal chamber, in a large hillock, is surrounded by innumerable quantities of others of different shapes, sizes, and dimensions, but all arched, some circularly, others elliptical or oval, which either open into each other, or communicate by wide and open passages. These apartments are

joined by the magazines and nurseries. The former are chambers of clay, and are always well filled with provisions, principally gums, and the inspissated juices of plants. These magazines are intermixed with the nurseries, buildings quite different from the rest of the apartments, composed entirely of wooden materials conjoined together. They are invariably occupied by eggs and young ones, which are at first as white as snow. They are placed all round the royal chamber, and as near it as possible. As in process of time the queen enlarges, her apartment must also be enlarged, and, as she now lays many more eggs, the small nurseries are broken down, and rebuilt at a greater distance, of larger size and in increased number. In the early state of the nest, they are not bigger than a hazel-nut, but in great hills are often as large as a child's head of a year old: they are inclosed in chambers of clay, like the magazines, but are much larger.

The arrangement in the interior is commonly according to the following plan: The royal chamber is near the centre, on a level with the ground, and directly under the apex of the hill. It is on all sides surrounded by the royal apartments, where the labourers and soldiers wait to guard and serve their common parents. These apartments extend a foot or more on every side round the royal chamber. Here the nurseries and magazines commence, and are continued on all sides, along with the galleries to the outward shell, reaching to within two-thirds of its height, leaving an open area in the middle, under the dome, resembling the nave of a cathedral: this is surrounded by three or four very large Gothic arches, which are sometimes two or three feet high next the centre, whence they diminish as they recede, and are lost in the innumerable chambers and nurseries behind them. The great interior area supplies heated air all around. There are also great subterranean passages and galleries lined with the same thick clay, which ascend the outward shell in a spiral manner, opening into the dome, new turrets, &c. These sloping descents reach a depth of three or four perpendicular feet, and from them is procured the clay, which, being worked in the mouths of these animals, becomes almost as hard as stone. In this way the cities spread to a vast extent, so that, if you destroy all the nests within 100 yards of your dwelling, the inhabitants of those unmolested farther off will nevertheless carry on their subterranean galleries, and will invade you by sap and mine, so doing great mischief to your goods and property.

Mr. Smeathman (Phil. Trans. lxxi.) conceives that the workers are *larvæ*, the soldiers *nymphæ*, and the king and queen the perfect insects. In this opinion he coincides with Sparrmann and others; but M. Latreille is inclined to think from what he observed in an European species, (*T. lucifugus*), found near Bordeaux, that the soldiers form a distinct race, like the neuters among bees and ants, while the workers are *larvæ*, which, when they become nymphs, are supplied with the rudiments of four wings, which are fully developed in the perfect insect. The *worker* is less than one-fourth of an inch in length, delicate and slender, having a distinct head, chest, and abdomen, with six legs, and is wholly of a brownish colour. The *soldiers* are much larger, being half an inch long, and equal in bulk to fifteen labourers. There is, moreover, a remarkable difference in the form of the head and mouth; for in the worker the mouth is evidently calculated for gnawing, whilst in the other, the jaws are shaped like two very sharp awls, somewhat jagged, the head at the same time being larger than all the rest of the body put together, and quite horny, having jaws like crab's claws, so that they are incapable of anything else than piercing or wounding. In the perfect state the insect varies in form still more than ever. The head,

thorax, and abdomen, differ almost entirely from the same parts in the other two classes; and, besides, the creature is now furnished with four large transparent wings, with which, at the time of emigration, it is to wend its way in search of a new settlement. In the winged state they alter their size as much as their form. Their bodies now measure between six and seven lines, and their wings two and a half inches from tip to tip, and they are equal in bulk to about 30 labourers, or two soldiers. They are now also furnished with two large eyes, placed on each side of the head; whilst in the others they are not easily distinguished. It is in this form the animal comes abroad, with the first showers of the rainy season, which usually occur at night, and if the rain continues, the quantities which cover the surface of the earth, and particularly the waters, are astonishing; for their wings are persistent only for a few hours, and after the rising of the sun, not one in a thousand is to be found with four wings, and probably not a pair in many millions get into a place of safety, to fulfil the first law of nature, and lay the foundation of a new community. The dangers of these insects are immensely increased by their almost innumerable foes, for all kinds of ants, and many other insects, as well as reptiles and birds, and man himself, are their implacable foes, devouring them, quite resistless, with the keenest relish. A few, however, do escape; and being found by some of the labourers, are elected the monarchs of new states: they are immediately enclosed in the royal chamber formerly described. After this, the work of propagation soon commences, and the labourers constructing the required nurseries carry the eggs, and lodge them safely on obtaining them from the queen. It is about this time that the most extraordinary change commences in the appearance of the queen. The abdomen gradually extends, and enlarges to such an enormous size, that in an old queen it is increased to 1,500 or 2,000 times the bulk of the rest of the body, and 20,000 or 30,000 times the size of a labourer. When about two years old, the abdomen is about three inches in length, and sometimes it is found twice that size. It has now become one vast matrix full of eggs, and has a peristaltic motion, resembling the undulation of the waves, which continues incessantly, without any apparent effort of the animal, protruding eggs to the amount of 60 in a minute, or 80,000 and upwards in a day. These eggs are immediately removed from her body by the attendants, and are carried to the nurseries, some four or five feet distant, in a straight line, and consequently much farther by their winding galleries. Here, on being hatched, the young are attended, and provided with every necessary, till they are able to shift for themselves, and take their proper share in the ordinary labours of the innumerable community.

CHAP. VI.

OF THE BEETLE, AND ITS VARIETIES.

HITHERTO we have been treating of insects with four transparent wings, we now come to a tribe with two transparent wings, with cases that cover them close while at rest, but which allow them their proper play when flying. The principal of these are the Beetle, the May-bug, and the Cantharis. These are all bred like the rest of their order, first from eggs, then they become grubs, then a chrysalis, in which the parts of the

future fly are distinctly seen; and, lastly, the animal leaves its prison, breaking forth as a winged animal in full maturity.

Of the Beetle there are various kinds; all, however, concurring in one common formation of having cases to their wings, which are the more necessary to those insects, as they often live under the surface of the earth, in holes which they dig out by their own industry. These cases prevent the various injuries their real wings might sustain, by rubbing or crushing against the sides of their abode. These, though they do not assist flight, yet keep the internal wings clean and even, and produce a loud buzzing noise when the animal rises in the air.

If we examine the formation of all animals of the beetle kind, we shall find, as in shell-fish, that their bones are placed externally, and their muscles within. These muscles are formed very much like those of quadrupeds, and are endued with such surprising strength, that, bulk for bulk, they are a thousand times stronger than those of a man.—The strength of these muscles is of use in digging the animal's subterranean abode, where it is most usually hatched, and to which it most frequently returns, even after it becomes a winged insect, capable of flying.

Beside the difference which results from the shape and colour of these animals, the size also makes a considerable one; some beetles being not larger than the head of a pin, while others, such as the elephant beetle, are as big as one's fist. But the greatest difference among them is, that some are produced in a month, and in a single season go through all the stages of their existence; while others take near four years to their production, and live as winged insects a year more. To give the history of all these animals, that are bred pretty much in the same way, would be insipid and endless; it will suffice to select one or two from the number, the origin of which may serve as specimens of the rest. I will, therefore, offer the history of the May-bug to the reader's attention; premising that most other beetles, though not so long-lived, are bred in the same manner.

The May-bug, or dofr-beetle, as some call it, has, like all the rest, a pair of cases to its wings, which are of a reddish brown colour, sprinkled with a whitish dust, which easily comes off. In some years their necks are seen covered with a red plate, and in others with a black; these, however, are distinct sorts, and their difference is by no means accidental. The fore-legs are very short, and the better calculated for burrowing in the ground, where this insect makes its retreat. It is well known, for its evening buzz, to children; but still more formidably introduced to the acquaintance of husbandmen and gardeners; for, in some seasons, it has been found to swarm in such numbers as to eat up every vegetable production.

The two sexes in the may-bug are easily dis-

tinguished from each other, by the superior length of the tufts, at the end of the horns, in the male. They begin to copulate in summer; and at that season they are seen joined together a considerable time. The female being impregnated, quickly falls to boring a hole into the ground, where to deposit her burden. This is generally about half a foot deep, and in it she places her eggs, which are of an oblong shape, with great regularity, one by the other. They are of a bright yellow colour, and no way wrapped up in a common covering, as some have imagined. When the female is lightened of her burden, she again ascends from her hole, to live as before, upon leaves and vegetables, to buzz in the summer evening, and to lie hid among the branches of trees in the heat of the day.

In about three months after these eggs have been thus deposited in the earth, the contained insect begins to break its shell, and a small grub or maggot crawls forth, and feeds upon the roots of whatever vegetable it happens to be nearest.

All substances of this kind seem equally grateful, yet it is probable the mother insect has a choice among what kind of vegetables she shall deposit her young. In this manner these voracious creatures continue in the worm state, for more than three years, devouring the roots of every plant they approach, and making their way under ground, in quest of food, with great despatch and facility. At length they grow to above the size of a walnut, being a great thick white maggot with a red head, which is seen most frequently in new-turned earth, and which is so eagerly sought after by birds of every species. When largest, they are found an inch and a half long, of a whitish yellow colour, with a body consisting of twelve segments or joints, on each side of which there are nine breathing-holes, and three red feet. The head is large in proportion to the body, of a reddish colour, with a pincer before, and a semicircular lip, with which it cuts the roots of plants, and sucks out their moisture. As this insect lives entirely under ground, it has no occasion for eyes, and accordingly it is found to have none; but is furnished with two feelers, which, like the crutch of a blind man, serve to direct its motion. Such is the form of this animal, that lives for years in the worm state under ground, still voracious, and every year changing its skin.

It is not till the end of the fourth year, that this extraordinary insect prepares to emerge from its subterraneous abode, and even this is not effected, but by a tedious preparation. About the latter end of autumn, the grub begins to perceive the approach of its transformation; it then buries itself deeper and deeper in the earth, sometimes six feet beneath the surface, and there forms itself a copious apartment, the walls of which it renders very smooth and shining by the excretions of its body. Its abode being thus formed, it begins, soon after, to shorten itself, to

swell, and to burst its last skin, in order to assume the form of a chrysalis. This, in the beginning, appears of a yellowish colour, which heightens by degrees, till at last it is seen nearly red. Its exterior form plainly discovers all the vestiges of the future winged insect, all the fore-parts being distinctly seen; while behind the animal seems as if wrapped in swaddling-clothes.

The young May-bug continues in this state for about three months longer; and it is not till the beginning of January, that the aurelia divests itself of all its impediments, and becomes a winged insect, completely formed. Yet still the animal is far from attaining its natural strength, health, and appetite. It undergoes a kind of infant imbecility; and, unlike most other insects, that the instant they become flies are arrived at their state of full perfection, the May-bug continues feeble and sickly. Its colour is much brighter than in the perfect animal, all its parts are soft, and its voracious nature seems, for a while, to have entirely forsaken it. As the animal is very often found in this state, it is supposed, by those unacquainted with its real history, that the old ones of the former season have buried themselves for the winter, in order to revisit the sun the ensuing summer. But the fact is, the old one never survives the season, but dies like all the other winged tribe of insects, from the severity of cold in winter.

About the latter end of May, these insects, after having lived for four years under ground, burst from the earth, when the first mild evening invites them abroad. They are at that time seen rising from their long imprisonment, from living only upon roots, and imbibing only the moisture of the earth, to visit the mildness of the summer air, to choose the sweetest vegetables for their banquet, and to drink the dew of the evening. Wherever an attentive observer then walks abroad, he will see them bursting up before him in his pathway, like ghosts on a theatre. He will see every part of the earth, that had its surface beat into hardness, perforated by their egression. When the season is favourable for them, they are seen by myriads buzzing along, hitting against every object that intercepts their flight. The mid-day sun, however, seems too powerful for their constitutions; they then lurk under the leaves and branches of some shady tree; but the willow seems particularly their most favourite food; there they lurk in clusters, and seldom quit the tree till they have devoured all its verdure. In those seasons which are favourable to their propagation, they are seen on an evening as thick as flakes of snow, and hitting against every object with a sort of capricious blindness. Their duration, however, is but short, as they never survive the season. They begin to join shortly after they have been let loose from their prison, and when the female is impregnated, she cautiously bores a hole in the ground, with an instrument fitted for that pur-

pose, which she is furnished with at the tail, and there deposits her eggs, generally to the number of threescore. If the season and the soil be adapted to their propagation, these soon multiply as already described, and go through the noxious stages of their contemptible existence. This insect, however, in its worm state, though prejudicial to man, makes one of the chief repasts of the feathered tribe, and is generally the first nourishment with which they supply their young. Rooks and hogs are particularly fond of these worms, and devour them in great numbers. The inhabitants of the county of Norfolk, some time since, went into the practice of destroying their rookeries, but in proportion as they destroyed one plague, they were pestered with a greater; and these insects multiplied in such an amazing abundance, as to destroy not only the verdure of the fields, but even the roots of vegetables not yet shot forth. One farm in particular was so injured by them in the year 1751, that the occupier was not able to pay his rent, and the landlord was content not only to lose his income for that year, but also gave money for the support of the farmer and his family. In Ireland they suffered so much by these insects, that they came to a resolution of setting fire to a wood, of some miles in extent, to prevent their mischievous propagation.¹

¹ Among the numberless species of grubs which annoy the farmer and gardener, the one described above is the most destructive. It is the larvæ of the May-bug or Cockchafer. It is not so common in Scotland as England and Ireland, in which latter country it is called the Connaught worm. "The mother-cockchafer," says Mr. Rennie in his work on 'Insect Transformations,' "when about to lay her eggs, digs into the earth of a meadow or a corn-field to the depth of a span, and deposits them in a cluster at the bottom of the excavation. Rosel, in order to watch their proceedings, put some females into glasses half-filled with earth, covered with a tuft of grass, and a piece of thin muslin. In a fortnight, he found some hundreds of eggs deposited, of an oval shape and a pale yellow colour. Placing the glass in a cellar, the eggs were hatched towards autumn, and the grubs increased remarkably in size. In the following May they fed so voraciously that they required a fresh turf every second day; and even this proving too scanty provender, he sowed in several garden pots a crop of pease, lentils, and salad, and when the plants came up, he put a pair of grubs into each pot; and in this manner he fed them through the second and third years. During this period, they cast their skins three or four times, going for this purpose deeper into the earth, and burrowing out a hole where they might effect their change undisturbed; and they do the same in winter, during which they become torpid and do not eat. When the grub changes into a pupa, in the third autumn after it is hatched, it digs a similar burrow about a yard deep; and when kept in a pot, and prevented from going deep enough, it shows great uneasiness, and often dies. The perfect beetle comes forth from the pupa in January or February; but it is then as soft as it was whilst still a grub, and does not acquire its hardness and colour for ten or twelve days, nor does it venture above ground before May, on the fourth year from the time of its hatching. At this

Of all the beetle kind this is the most numerous, and therefore deserves the chief attention of history. The numerous varieties of other kinds might repay the curiosity of the diligent observer, but we must be content in general to observe, that in the great outlines of their history, they resemble those of which we have just been giving a description; like them all other beetles are bred from the egg, which is deposited in the ground, or sometimes, though seldom, in the barks of trees, they change into a worm; they subsist in that state by living upon the roots of vegetables, or the succulent part of the bark round them. They generally live a year at least before they change into an aurelia; in that state

time, the beetles may be observed issuing from their holes in the evening, and dashing themselves about in the air as if blind; hence the common saying, 'as blind as a beetle.' During the three summers then of their existence in the grub state, these insects do immense injury, burrowing between the turf and the soil, and devouring the roots of grass and other plants; so that the turf may easily be rolled off, as if cut by a turfing spade, while the soil underneath for an inch or more is turned into soft mould like the bed of a garden. The best way of preventing the ravages of these insects would be to employ children to collect the perfect insects when they first appear, before they lay their eggs; but when a field is once overrun with the larvæ, nothing can be done with it except paring and burning the surface, or ploughing it up, and turning in a flock of ducks or other poultry, or a drove of pigs, which are said to eat these grubs, and to fatten on the fare. Drenching the field with stable urine by means of reservoir carts, like those used for watering roads, would, if sufficiently done, both kill the grubs, and beneficially manure the land."

The grub called the *wire worm*, though not very appropriately, is the larva of the spring or click beetles, known by their long flattish body, and their power of springing with a clicking sound out of the hand when caught. The grubs of the click beetles are said to continue five years before producing the perfect insect. During this time the grub feeds chiefly on the roots of wheat, rye, oats, barley, and grass; but seems also sometimes to attack the larger roots of potatoes, carrots, and salads. Its ravages are often so extensive as to cut off entire crops of grain. It appears to be most partial to land newly broken up; and has not been found so abundant in meadows and pastures, unless in fields recently laid down with grass. "The wire worm," says Spence, "is particularly destructive for a few years in gardens recently converted from pasture-ground. In the botanic garden at Hull, thus circumstanced, a great proportion of the annuals sown in 1813 were destroyed by it. A very simple and effectual remedy in such cases, was mentioned to me by Sir Joseph Banks. He recommended that slices of potatoes, stuck upon skewers, should be buried near the seed sown, examined every day, and the wire worms, which collect upon them in great numbers, destroyed." The wire worm is long, slender, and very tough and hard; but otherwise it has no resemblance to wire, being whitish in colour, of a flattish form, and jointed or ringed. Its breathing spiracles, two in number, are on the back of its last ring. An insect of this family is exceedingly destructive, in the West Indies, to the sugar-cane; the grub, according to Humboldt and Bonpland, feeding on its roots and killing the plants.—Ed.

they are not entirely motionless, nor entirely swaddled up without form.

It would be tedious and endless to give a description of all; and yet it would be an unpardonable omission not to mention the particularities of some beetles, which are singular rather than those animals are generally found to be, and so strong, though not much larger than the common black beetle, that if one of them be put under a brass candlestick, it will cause it to move backwards and forwards, as if it were by an invisible hand, to the admiration of those who are not accustomed to the sight; but this strength is given it for much more useful purposes than those of exciting human curiosity, for there is no creature more laborious, either in seeking subsistence, or in providing a proper retreat for its young. They are endowed with sagacity to discover subsistence by their excellent smelling, which directs them in flights to excrements just fallen from man or beast, on which they instantly drop, and fall unanimously to work in forming round balls or pellets thereof, in the middle of which they lay an egg. These pellets, in September, they convey three feet deep in the earth, where they lie till the approach of spring; when the eggs are hatched the nests burst, and the insects find their way out of the earth. They assist each other with indefatigable industry, in rolling these globular pellets to the place where they are to be buried. This they are to perform with the tail foremost, by raising up their hinder part, and shoving along the ball with their hind feet. They are always accompanied with other beetles of a larger size, and of a more elegant structure and colour. The breast of this is covered with a shield of a crimson colour, and shining like metal; the head is of the like colour, mixed with green, and on the crown of the head stands a shining black horn, bended backwards. These are called the kings of the beetles; but for what reason is uncertain, since they partake of the same dirty drudgery with the rest.

The Elephant-beetle is the largest of this kind hitherto known, and is found in South America, particularly Guiana and Surinam, as well as about the river Oroonoko. It is of a black colour, and the whole body is covered with a very hard shell, full as thick and as strong as that of a small crab. Its length, from its hinder part to the eyes, is almost four inches, and from the same part to the end of the proboscis, or trunk, four inches and three quarters. The transverse diameter of the body is two inches and a quarter, and the breadth of each elytron, or case for the wings, is an inch and three-tenths. The antennæ, or feelers, are quite horny; for which reason the proboscis, or trunk, is moveable at its insertion into the head, and seems to supply the

place of feelers. The horns are eight-tenths of an inch long, and terminate in points. The proboscis is an inch and a quarter long, and turns upwards, making a crooked line, terminating in two horns, each of which is near a quarter of an inch long; but they are not perforated at the end like the proboscis of other insects. About four-tenths of an inch above the head, on that side next the body, is a prominence or small horn, which, if the rest of the trunk were away, would cause this part to resemble the horn of a rhinoceros. There is indeed a beetle so called, but then the horn or trunk has no fork at the end, though the lower horn resembles this. The feet are all forked at the end, but not like lobsters' claws.²

To this class we may also refer the Glow-worm, that little animal which makes such a distinguished figure in the descriptions of our poets. No two insects can differ more than the male and female of this species from each other. The male is in every respect a beetle, having cases to its wings, and rising in the air at pleasure; the female, on the contrary, has none, but is entirely a creeping insect, and is obliged to wait the approaches of her capricious companion. The body of the female has eleven joints, with a shield breast-plate, the shape of which is oval; the head is placed over this, and is very small, and the three last joints of her body are of a yellowish colour; but what distinguishes it from all other animals, at least in this part of the world, is the shining light which it emits by night, and which is supposed by some philosophers to be an emanation which she sends forth to allure the male to her company. Most travellers who have gone through sandy countries, must well remember the little shining sparks with which the ditches are studded on each side of the road. If incited by curiosity to approach more nearly, he will find this light sent forth by the glow-worm; if he should keep the little animal for some time, its light continues to grow paler, and at last appears totally extinct. The manner in which this light is produced has hitherto continued inexplicable; it is probable the little animal is supplied with some electrical powers, so that by rubbing the joints of its body against each other, it thus supplies a stream of light, which if it allures the male, as we are told, serves for very useful purposes.³

² See Supplementary Note, p. 481.

³ It is a question by no means decided, whether the light of the female glow-worm is intended for the purpose popularly and poetically believed,—as the lamp of love to attract and direct the vagrant male. Baron de Geer says that "this insect shines in its infant state, in that of larva, and even after it has taken the form of a nymph. Now, as in the first of these states it cannot propagate, and still less in the second, with what design is the light displayed? It must serve some purpose yet unknown. The authors who have spoken of the male glow-worms say positively that they shine in the dark as well as females."

The *Cantharis* is of the beetle kind, from whence come cantharides, well known in the shops by the name of Spanish flies, and for their use in blisters. They have feelers like bristles, flexible cases to the wings, a breast pretty plain, and the sides of the belly wrinkled. *Cantharides* differ from each other in their size, shape, and colour; those used in the shops also do the same. The largest in these parts are about an inch long, and as much in circumference, but others are not above three quarters of an inch. Some are of a pure azure colour, others of pure gold, and others again have a mixture of pure gold

"We have," says Mr. Rennie, "in two instances observed this luminosity of the male, which, however, is much more feeble than that of the female. Ray first discovered this fact in the common glow-worm, and Geoffroy and Muller give their testimony to its accuracy; while Illiger records it as occurring still more remarkably in two foreign species (*Lampyrus splendidula*, and *L. hemiptera*). Kirby and Spence made an attempt to rebut the inferences drawn from these facts, by remarking that the circumstance of the male having the same luminous property, no more proves that the superior brilliancy of the female is not intended for conducting him to her, than the existence of nipples and sometimes of milk in the breast of man, proves that the breast of woman is not meant for the support of her offspring. But we do not see how the light in the male glow-worm can be thus compared with such decidedly sexual organs, though in the larva it may certainly be explained upon the principle of gradual development. Mr. Main thinks that the design of the light in the female is proved by the propensity of the males to fly towards light, and states that they have been seen in such numbers, as sometimes to cover a table round a lighted candle in an open room. But he surely forgets that gnats and moths do the same, although their females are not luminous. In a still more splendid luminous insect, the fire-fly of tropical countries, we are not informed whether the light is in any way connected with pairing. The insect itself is one of the click-beetles, several others of which are also luminous. Southey has given a spirited and accurate description of this fire-fly:—

"soon did night display
More wonders than it veild: innumerable tribes
From the wood-cover swarmed, and darkness made
Their beauties visible: one while they streamed
A bright blue radiance upon flowers that closed
Their gorgeous colours from the eye of day;
Now motionless and dark, eluded search,
Self-shrouded; and anon, starring the sky,
Rose like a shower of fire."—*Madoc*.

We are told by Mouffet, that when Sir Thomas Cavendish and Sir Robert Dudley landed in the West Indies, and saw in the evening an infinite number of moving lights in the woods, which, though nothing more than fire-flies, were taken by them for Spaniards advancing upon them by torch-light, they immediately fled to their ships. We are not aware that any native insect is luminous besides the glow-worm and the electric centipede, which is by no means uncommon, though its light is seldom seen, in consequence of its living in holes or under ground, from which it is seldom roused during the night. We have, however, more than once seen it in out-houses, or crawling along a pathway, upon which it sometimes leaves a track of phosphoric matter that may be lifted. On two different occasions we collected some of this, but it disappeared, probably by evaporation, before we could subject it to chemical analysis."—*Insect Miscellanies*.

and azure colours; but they are all very brilliant and extremely beautiful. These insects, as is well known, are of the greatest benefit to mankind, making a part in many medicines conducive to human preservation. They are chiefly natives of Spain, Italy, and Portugal; but they are to be met with also about Paris in the summer time, upon the leaves of the ash, the poplar, and the rose-trees, and also among wheat, and in meadows. It is very certain, that these insects are fond of ash-leaves, insomuch that they will sometimes strip one of these trees quite bare. Some affirm that these flies delight in sweet-smelling herbs; and it is very certain, that they are fond of honey-suckles, lilac, and wild-cherry shrubs; but some that have sought after them declare they never could find them on elder-trees, nut-trees, and among wheat. We are told that the country people expect the return of these insects every seven years. It is very certain, that such a number of these insects have been seen together in the air, that they appeared like swarms of bees; and that they have so disagreeable a smell, that it may be perceived a great way off, especially about sunset, though they are not seen at that time. This bad smell is a guide for those who make it their business to catch them. When they are caught they dry them, after which they are so light, that fifty will hardly weigh a drachm. Those that gather them tie them in a bag, or a piece of linen cloth, that has been well worn, and then they kill them with the vapours of hot vinegar, after which they dry them in the sun, and keep them in boxes. These flies, thus dried, being chemically analyzed, yield a great deal of volatile caustic salt, mixed with a little oil, phlegm, and earth. *Cantharides* are penetrating, corrosive, and applied to the skin, raise blisters, from whence proceeds a great deal of serosity. They are made use of both inwardly and outwardly. However, it is somewhat strange that the effects of these flies should fall principally upon the urinary passages; for though some authors have endeavoured to account for this, we are still in the dark, for all they have said amounts to no more than that they affect these parts in a manner which may be very learnedly described, but very obscurely comprehended.

An insect of great, though perhaps not equal use in medicine, is that which is known by the name of the *Kermes*; it is produced in the excrescence of an oak, called the berry-bearing ilex, and appears at first wrapt up in a membranaceous bladder, of the size of a pea, smooth and shining, of a brownish-red colour, and covered with a very fine ash-coloured powder. This bag teems with a number of reddish eggs or insects, which being rubbed with the fingers pour out a crimson liquor. It is only met with in warm countries in the months of May and June. In the month of April this insect becomes of the size and shape of a pea, and

its eggs some time after burst from the womb, and soon turning worms, run about the branches and leaves of the tree. They are of two sexes, and the females have been hitherto described; but the males are very distinct from the former, and are a sort of small flies like gnats, with six feet, of which the four forward are short, and the two backward long, divided into four joints, and armed with three crooked nails. There are two feelers on the head, a line and a half long, which are moveable, streaked, and articulated. The tail, at the back part of the body, is half a line long, and forked. The whole body is covered with two transparent wings, and they leap about in the manner of fleas. The harvest of the kermes is greater or less in proportion to the severity of the winter, and the women gather them before sun-rising, tearing them off with their nails, for fear there should be any loss from the hatching of the insects. They sprinkle them with vinegar, and lay them in the sun to dry, where they acquire a red colour.

An insect, perhaps, still more useful than either of the former, is the *Cochineal*, which has been very variously described by authors; some have supposed it a vegetable excrescence from the tree upon which it is found; some have described it as a louse; some, as a bug; and some, as a beetle. As they appear in our shops when brought from America, they are of an irregular shape, convex on one side, and a little concave on the other; but are both marked with transverse streaks or wrinkles. They are of a scarlet colour within, and without of a blackish red, and sometimes of a white, reddish, or ash colour, which are accounted the best, and are brought to us from Mexico. The cochineal insect is of an oval form, of the size of a small pea, with six feet, and a snout or trunk. It brings forth its young alive, and is nourished by sucking the juice of the plant. Its body consists of several rings, and when it is once fixed on the plant, it continues immovable, being subject to no change. Some pretend there are two sorts, the one domestic, which is best; and the other wild, that is of a vivid colour; however, they appear to be the same, only with this difference, that the wild feeds upon uncultivated trees, without any assistance, whereas the domestic is carefully, at a stated season, removed to cultivated trees, where it feeds upon a purer juice. Those who take care of these insects, place them on the prickly-pear plant in a certain order, and are very industrious in defending them from other insects; for if any other kind come among them, they take care to brush them off with foxes' tails. Towards the end of the year, when the rains and cold weather are coming on, which are fatal to these insects, they take off the leaves or branches covered with cochineal, that have not attained their utmost degree of perfection, and keep them in their houses till winter is past. These leaves are very thick and juicy, and supply them with

sufficient nourishment, while they remain within doors. When the milder weather returns, and these animals are about to exclude their young, the natives make them nests, like those of birds, but less, of tree moss, or soft hay, or the down of cocoa-nuts, placing twelve in every nest. These they fix on the thorns of the prickly-pear plant, and in three or four days' time they bring forth their young, which leave their nests in a few days, and creep upon the branches of the plant, till they find a proper place to rest in, and take in their nourishment; and until the females are fecundated by the males, which, as in the former tribe, differ very widely from the females, being winged insects, whereas the others only creep, and are at most stationary. When they are impregnated, they produce a new offspring, so that the propagator has a new harvest thrice a-year. When the native Americans have gathered the cochineal, they put them into holes in the ground, where they kill them with boiling water, and afterwards dry them in the sun, or in an oven, or lay them upon hot plates. From the various methods of killing them, arise the different colours which they appear in when brought to us. While they are living they seem to be sprinkled over with a white powder, which they lose as soon as the boiling water is poured upon them. Those that are dried upon hot plates are the blackest. What we call the cochineal are only the females, for the males are a sort of fly, as already observed in the kermes. They are used both for dying and medicine, and are said to have much the same virtue as the kermes, though they are now seldom used alone, but are mixed with other things for the sake of the colour.

I shall end this account of the beetle tribe with the history of an animal which cannot properly be ranked under this species, and yet cannot be more methodically ranged under any other. This is the insect that forms and resides in the gall-nut, the spoils of which are converted to such useful purposes. The gall-insects are bred in a sort of bodies adhering to a kind of oak in Asia, which differ with regard to their colour, size, roughness, smoothness, and shape, and which we call galls. They are not fruit, as some have imagined, but preternatural tumours, owing to the wounds given to the buds, leaves, and twigs of the tree, by a kind of insects that lay their eggs within them. This animal is furnished with an implement, by which the female penetrates into the bark of the tree, or into that spot which just begins to bud, and there sheds a drop of corrosive fluid into the cavity. Having thus formed a receptacle for her eggs, she deposits them in the place, and dies soon after. The heart of the bud being thus wounded, the circulation of the nutritive juice is interrupted, and the fermentation thereof, with the poison injected by the fly, burns the parts adjacent, and then alters the natural colour of the plant. The

juice or sap, turned back from its natural course, extravasates, and flows round the egg. After which it swells and dilates by the assistance of some bubbles of air, which get admission through the pores of the bark, and which run in the vessels with the sap. The external coat of this excrescence is dried by the air, and grows into a figure, which bears some resemblance to the bow of an arch, or the roundness of a kernel. This little ball receives its nutriment, growth, and vegetation, as the other parts of the tree, by slow degrees, and is what we call the *gall-nut*. The worm that is hatched under this spacious vault, finds in the substance of the ball, which is as yet very tender, a subsistence suitable to its nature; gnaws and digests it till the time comes for its transformation to a nymph, and from that state of existence changes into a fly. After this, the insect, perceiving itself duly provided with all things requisite, disengages itself soon from its confinement, and takes its flight into the open air. The case, however, is not similar with respect to the *gall-nut* that grows in autumn. The cold weather frequently comes on before the worm is transformed into a fly, or before the fly can pierce through its enclosure. The nut falls with the leaves, and although you may imagine that the fly which lies within is lost, yet in reality it is not so; on the contrary, its being covered up so close, is the means of its preservation. Thus it spends the winter in a warm house, where every crack and cranny of the nut is well stopped up; and lies buried, as it were, under a heap of leaves, which preserves it from the injuries of the weather. This apartment, however, though so commodious a retreat in the winter, is a perfect prison in the spring. The fly, roused out of its lethargy by the first heats, breaks its way through, and ranges where it pleases. A very small aperture is sufficient, since at this time the fly is but a diminutive creature. Besides, the ringlets whereof its body is composed, dilate, and become pliant in the passage.

SUPPLEMENTARY NOTE.

We shall here notice some of the more important of the numerous species of beetles.

The *Bombardier*, or *Exploding beetle*, has the head, antennæ, thorax and feet of a brownish red colour. The eyes are black, and the abdomen and wing-cases blue, bordering on black; the latter are marked with broad but shallow striae. This insect is sometimes found in England. It conceals itself among stones, and seems to make little use of its wings. When it moves it is by a sort of jump; and when it is touched, we are surprised with a noise resembling the discharge of a musquet in miniature, during which a blue smoke may be seen to proceed from its extremity. The insect may at any time be made to play off its artillery by scratching its back with a needle. If we may believe Rolander, who first made these observations, it can give twenty discharges successively. A bladder, placed near its posterior extremity, is the arsenal that contains its store. This is its chief defence against its enemies; and

the vapour, or liquid, that proceeds from it is of so pungent a nature, that, if it happen to be discharged into the eyes, it makes them smart as if brandy had been thrown into them. The principal enemy of the bombardier is another insect of the same tribe, but three or four times its size. When pursued or fatigued, the bombardier has recourse to this stratagem: he lies down in the path of his enemy, who advances with open mouth to seize him; but on the discharge of the artillery, this suddenly draws back, and remains for a while confused, during which the bombardier conceals himself in some neighbouring crevice; but, if not lucky enough to find one, the other returns to the attack, takes the insect by the head and tears it off.

The *Musk-beetle* derives its name from its musky smell. The grubs from which these beetles proceed resemble soft, slender worms, and are provided with six hard legs. They are commonly white, and penetrate into the inner part of trees for the purpose of obtaining food, and likewise a retreat after they are transformed into nymphs. As soon as the last change is completed, the winged capricorn is seen issuing from these cavities, and may then be very easily caught. Many of these beetles emit an odour which is perceived to a considerable distance; and when they are laid hold of, produce a sound which is supposed to be occasioned by the friction of the thorax and abdomen.

The *Larger Musk-scented Green Capricorn beetle* is a very large, beautiful insect, being of a glossy, brilliant, bluish green colour, with a cast of a shining golden yellow. The upper part of the body is blue, and the wings underneath the cases are black. The legs are of the same bluish green colour, but rather paler; each side of the breast is furnished with a sharp protuberance; between these points are three small tubercles near the wings, and three others towards the head. The cases of the wings are oblong, and have three ribs somewhat elevated, which run lengthwise. The feelers are as long as the body, and are composed of many small joints, which decrease in size towards the ends. It frequents the leaves of the willow, and has an agreeable musky smell.

The *Rhinoceros beetle* is very rare, and inhabits Asia. The throat is retuse and unarmed; the horn on the head simple and slightly curved; the shield is bifid; and the shells punctated. The body is of a pitchy black; beneath hairy. The throat of the female is excavate. The *Elephant beetle* will be found described in the text.

The *Goliath beetle* is one of the largest of its tribe, and is a native of several parts of Africa. Its horns are elevate, with a fissile tip. The legs are generally toothed; the body is thick and compact; the throat is unarmed, and the head somewhat forked.

The *Midas beetle* has the antennæ divided at the tip, or head, into several lamellæ; the joints of the fore-legs are generally toothed; its thorax is broad and treble-horned; with a double-horned sinuated clypeus. In the beetle tribe we are presented with a wonderful, and as it were almost capricious diversity of form; every variation of horn and process, that imagination can conceive, being exemplified in the different species of this extensive genus; and if their size approached to that of the larger animals, even the monsters of romance would be exceeded by the realities of nature. In some the head alone is horned, in others the thorax only, and in others both head and thorax are furnished with these appendages. Amongst the rarest, as well as the most singular species, may be reckoned the *midas beetle*, which is a native of America, and particularly of South America. Its colour is deep black; but the under parts, especially towards the breast and the insertions of the legs, are coated with dark ferrugin-

ous down. The elytra, or wing-sheaths, are marked by a few longitudinal striae.

The *Kangaroo beetle* is another instance of the freaks of nature; for there hardly can be conceived an animated form more remarkable than the Kangaroo beetle. It is also to be observed, that, in general, the colour of the larger beetles is either black or brown, and seldom exhibits that rich assortment of brilliant hues so conspicuous in many of the smaller coleopterous insects. A striking exception, however, to this rule occurs in this insect, which to a form the most seemingly disproportioned unites the most beautiful colours, the whole animal on the upper surface being of the richest and most shining grass green, while the under surface is ornamented by a metallic lustre resembling that of burnished copper: this is particularly conspicuous on the hind legs, which are of so enormous a size in proportion to the rest of the animal, as to appear, at first view, rather an inconvenience to it. The animal may, however, be formed for leaping; for which purpose this extravagant size of leg may be well calculated. It is from this circumstance that it has received the title of kangaroo beetle.

In the *Golden beetle*, the antennae, or horns, are elevate, with a fissile tip; legs generally toothed; and the body thick and compact. The first segment of the abdomen is furnished on each side with a prominent tooth. The golden beetle is a species of peculiar beauty, and is about the size of the common black or garden beetle, but of a somewhat flatter shape, and of a more brilliant golden-green colour, sometimes marked towards the lower part of the wing-sheaths by a few transverse whitish streaks. This elegant animal is not uncommon during the hottest part of summer, frequenting various plants and flowers. The larva or caterpillar of the golden beetle is commonly found in the hollows of trees, or among the loose dry soil at their roots, and sometimes in the earth of ant-hills. It remains about three years before it changes to a chrysalis.

The *Stag-beetle* is so called from the singular form of its large moveable maxillae, which resemble the horns of a stag. These instruments project from the head nearly one-third of the animal's length, and are broad and flat. In the middle, towards the inner part they have a small branch, and the ends are forked. These romantic horns are supported by a head, short, broad, and irregular; the thorax intervening between it and the body is narrower than either, and marginated around. The colour of the whole animal is a deep brown, its shells or cases being perfectly plain and unadorned with either streaks or lines. The female stag-beetle is distinguished by having horns not above half as large as those of the male. They are both, however, armed on the anterior side with small teeth through their whole length. In both the male and female the horns are sometimes as red as coral, which gives the animal a very beautiful appearance. In some parts of the country these animals are very rare; their usual residence is the oak. Though here it grows to such a size as to be the largest of all coleopterous insects in this part of the world, yet in countries where the climate is warmer, and the forests more extensive, the stag-beetle arrives at a much greater bulk, and possesses uncommon strength and vigour. In those parts their horns become a formidable offensive weapon, and their bite is dreaded by those who have once experienced its effects.

The *Violet-beetle* is a beautiful insect of an oblong shape, and a dark violet colour; the edges of the cases to the wings and of the thorax are violet, with a shade of purple. The former are without either dots or streaks, but are marked lengthwise with deep wrinkles. This insect is most commonly found among rotten wood.

The *Elk-horned Stag-chaffer* has the antennae elevated with a compressed tip, divided into lamellae on the inner side: the jaws are stretched forwards, exerted and toothed. This rare species is a native of India.

The *Great Stag-beetle* is the largest of any insect found in Great Britain, measuring sometimes nearly three inches from the points of its jaw to the extremity of its abdomen. Its colour is entirely dark-brown, except the jaws, which are sometimes as red as coral, and give it a very beautiful appearance; by these, which somewhat resemble in form the horns of a stag, it is readily distinguished from all other insects. In some parts of the south of England, these insects are very common in the oak and willow trees, in the stumps or about the branches of which they remain hidden during the day; flying about and feeding on the leaves only in the evening. The month of July is the time during which they are principally seen. The males in particular have great strength in their mandibles or jaws. With these they are able to pinch very severely. It is a singular circumstance, with regard to these insects, that there have been found several of their heads near together, and all perfectly alive, while the trunks and abdomens were nowhere to be seen; sometimes only the abdomens have been found gone, while the heads and trunks have been left together. How this occurred has not yet been properly discovered; but it has been supposed, that it must have been in consequence of the severe battles which at times take place among these, the fiercest of the insect tribes: but their mouths not being formed for animal food, we are at a loss to guess what becomes of their abdomens. They do not fly till most of the birds have retired to rest; and indeed if we were to suppose that any of these devoured them, it would be difficult to say why the head or trunks alone should be rejected. The females deposit their eggs in decayed or worm-eaten trees. The larvæ, which are round and whitish, with rust-coloured head and legs, are nourished upon the bark. In this state they pass six years. When about to undergo their change into a chrysalis, each insect forms a hard and solid ball of the form of an egg, and sometimes as large as the hand. When the perfect insect issues forth, it is at first quite soft; its parts, however, soon harden, and in a little while it is able to fly away.

The bodies of the *Water-beetle* tribe are admirably formed for passing through the water with as little impediment as possible, being nearly boat-shaped, and on the surface perfectly smooth. They inhabit ponds and ditches, but occasionally fly abroad, in search of other waters. The males are distinguished from the females by having a horny concave flap or shield on the fore-legs. The hind-legs in both sexes are peculiarly adapted for the aquatic residence of the insects, being furnished on the inner sides with a series of long and close-set filaments, so as somewhat to resemble fins. In the large species the elytra or wing-cases of the males are smooth, and those of the females furrowed. The larvæ are extremely voracious, feeding on other aquatic insects, on worms, and even on fish. They continue in this state about two years and a half; and when about to change into the pupa state, they form a convenient cell, and secrete themselves for the purpose in the banks, or amongst the weeds.

The *Marginated Water-beetle* is black in the body. The edges of the thorax and other margins of the wing-cases are yellow. Although water is the principal element in which these insects reside, they are, like the rest of their tribe, perfectly amphibious. They may occasionally be found in all fresh waters, but are most frequently seen either in such as are stagnant, or where the stream is extremely slow. They are predatory and very voracious, devouring, in

great numbers, not only other water insects, but oftentimes also those of the land. They seize their prey in their fore-legs, and with these carry it to their mouths. Although they are able to continue immersed for a great length of time, yet it is necessary for them to rise occasionally to the surface of the water, in order to breathe. They swim with great celerity; and in flying make a humming or droning noise like beetles. The larvæ have powerful jaws, and six long legs. At the posterior part of their body, which tapers towards the extremity, there are two small slender processes, situated somewhat obliquely, and moveable at the base. It is by means of these that the larva suspends itself at the surface of the water, for the purpose of respiring the air of the atmosphere, which it does through two small cylindrical tubes, situated at the extremity of the tail.

To the beetle-kind also belong those animals which causes such alarm to the superstitious by their ticking noise. Various species of this insect are to be found in Britain.

The *Death-watch*, or *Pinus*, is a dusky or somewhat hairy insect, with irregular brownish spots, about a quarter of an inch in length. Notwithstanding its smallness, this creature is often the cause of serious alarm among the lower classes of people, from the noise that it makes at a certain time of the year, resembling the ticking of a watch. From this it has its name; for, whenever this faculty is exerted, it is esteemed portentive of death to some one of the family in the house where it is heard. It is chiefly in the advanced state of spring that this insect commences its noise, which is no more than a call or signal by which they are mutually attracted to each other; and it may be considered as analogous to the call of birds. This noise does not arise from the voice, but from the insect's beating on any hard substance with the shield or fore-part of the head. The general number of successive distinct strokes is from seven to nine, or eleven. These are given in pretty quick succession, and are repeated at uncertain intervals; and in old houses, where the insects are numerous, they may be heard, if the weather be warm, every hour in the day. The noise exactly resembles that made by beating with the nail upon a table. The insect being difficult to discover, from its obscure grayish-brown colour, nearly resembling that of decayed wood, it is not always easy to say from what exactly the sound proceeds. Mr. Stackhouse observed carefully the manner of its beating. He says the insect raises itself on its hinder legs, and with the body somewhat inclined, beats its head with great force and agility against the place on which it stands. One of them, on a sedge-bottomed chair, exerted so much force, that its strokes were impressed and visible in the exterior coat of the sedge, for a space equal to that of a silver penny. Mr. Stackhouse took this insect and put it into a box. On the following day he opened the box, and set it in the sun. It seemed very brisk, and crept about with great activity on the bits of sedge and rotten wood, till at last getting to the end of the pieces, it extended its wings, and was about to take flight; he shut down the lid, when it withdrew them, and remained quiet. He kept it by him about a fortnight. Strange as it may appear, this little animal is capable of being tamed. Dr. Derham kept a male and female together in a box for about three weeks; and by imitating their noise, (beating with his nail, or the point of a pen, on a table or board,) he made them beat whenever he pleased, and they would not only answer very readily, but even continued their beatings as long as required. At the end of this time one of them died, soon after which the other gnawed its way out and escaped. As to the identity of the death-watch, Mr. Westwood says: "It is to be observed, that more than one in-

sect is thus designated: the name, in fact, being a generic rather than a specific one; any unusual ticking being called the death-watch. The noise, however, made by the *A'tropos lignarius* is not near so loud as that of the *Andibium*. One species of this genus, *A. striatum*, bores into the painted wooden chimney-board of my study. The perfect insects appear, in the hottest part of the summer, flying about the room in search of their mates; but for many weeks previous to the appearance of the beetles, I hear the ticking in the interior of the chimney-board; and as it is most probable that these insects lie but a very short time in the pupa state, I cannot help thinking that this noise is caused by the larva in gnawing the wood with its powerful jaws. The females, after impregnation, must deposit their eggs either by boring into the wood with their ovipositor, or they probably creep into some of the old holes made on their exclusion, and so get into the wood without any trouble."

The *Death-watch Termes* is sometimes mistaken for the *pinus* just mentioned, is of a very different tribe, and about a tenth of an inch long. At first sight it has greatly the appearance of a louse: its mouth, however, with a glass, is seen to be reddish, and its eyes are yellow. The antennæ are sharply pointed, and somewhat long. It is sometimes, though very rarely, observed to have wings. This insect is usually found in old wood, decayed furniture, museums, and neglected books; and both the male and female have the power of making a ticking noise, not unlike that of a watch, to attract each other. The female lays her eggs in dry and dusty places, where they are likely to meet with the least disturbance: these are exceedingly small, and are not unlike the nits or eggs of lice. When they are disturbed, they are very shy in making their tickings; but if they can be viewed without being alarmed by noise, or moving the place where they are, they will not only beat freely, but even answer any person's beating with his nail. At every stroke their body shakes, or seems affected as by a sudden jerk; and these jerks succeed each other so quickly, that it requires great steadiness to perceive with the naked eye that the body has any motion. They are scarcely ever heard to beat before July, and never later than the sixteenth of August. It appears strange that so small an insect should be able to make a noise so loud as is frequently to be heard from this; sometimes equal to that of the strongest beating watch. Dr. Derham, who examined and first described this species, says, he had often heard the noise, and in pursuing it found nothing but these insects, which he supposed incapable of producing it; but one day, by finding that the noise proceeded from a piece of paper loosely folded, and lying in a good light in his study window, he viewed it through, and with a microscope observed, to his great astonishment, one of them in the very act of beating. In some years they are more numerous than in others, and their ticking is of course more frequently heard. We are informed by the above naturalist, that, during the month of July, in one particular summer, they scarcely ever ceased, either in the day or night.


CHAP. VII.

OF THE GNAT AND THE TIPULA.

THERE are two insects which entirely resemble each other in their form, and yet widely differ in their habits, manners, and propagation. Those who have seen the tipula, or long-legs, and the

larger kind of gnat, have most probably mistaken the one for the other; they have often accused the tipula, a harmless insect, of depredations made by the gnat, and the innocent have suffered for the guilty; indeed the differences in their form are so very minute, that it often requires the assistance of a microscope to distinguish the one from the other: they are both mounted on long legs, both furnished with two wings and a slender body; their heads are large, and they seem to be humpbacked; the chief and only difference, therefore, is, that the tipula wants a trunk, while the gnat has a large one, which it often exerts to very mischievous purposes. The tipula is a harmless peaceful insect, that offers injury to nothing; the gnat is sanguinary and predaceous, ever seeking out for a place in which to bury its trunk, and pumping up the blood from the animal in large quantities.

The gnat proceeds from a little worm, which is usually seen at the bottom of standing waters. The manner in which the insect lays its eggs is particularly curious: after having laid the proper number on the surface of the water, it surrounds them with a kind of unctuous matter, which prevents them from sinking, but at the same time fastens them with a thread to the bottom, to prevent their floating away, at the mercy of every breeze, from a place, the warmth of which is proper for their production, to any other, where the water may be too cold, or the animals' enemies too numerous. Thus the insects, in their egg state, resemble a buoy, which is fixed by an anchor. As they come to maturity they sink deeper; and at last, when they leave the egg as worms, they creep to the bottom.¹

¹ Goldsmith has fallen into error in the above description, as well as several other writers on natural history. "The problem of the gnat," says Mr. Rennie, "is to construct a boat-shaped raft, which will float, of eggs heavy enough to sink in water if dropped into it one by one. The eggs are nearly of the pyramidal form of a pocket gunpowder-flask, rather pointed at the upper and broad at the under end, with a projection like the mouth of a bottle. The first operation of the mother gnat is to fix herself by the four fore-legs to the side of a bucket, or upon a floating leaf, with her body level with and resting upon the surface of the water, excepting the last ring of the tail, which is a little raised; she then crosses her two hind legs in form of an X, the inner opening of which is intended to form the scaffolding of her structure. She accordingly brings the inner angle of her crossed legs close to the raised part of her body, and places in it an egg, covered, as is usual among insects, with a glutinous fluid. On each side of this egg she places another, all which adhere firmly together by means of their glue, and form a triangular figure thus , which is the stern of the raft. She proceeds in the same manner to add egg after egg in a vertical (not a horizontal) position, carefully regulating the shape by her crossed legs; and as her raft increases in magnitude, she pushes the whole gradually to a greater distance, and when she has about half-finished, she uncrosses her legs and places them parallel, the angle being no longer necessary for shaping the boat. Each raft consists of from two hundred and fifty to three

They now make themselves a lodgment of cement, which they fasten to some solid body at the very bottom of the water, unless, by accident, they meet with a piece of chalk, which being of a soft and pliant nature, gives them an opportunity of sinking a retreat for themselves, where nothing but the claws of a cray-fish can possibly molest them. The worm afterwards changes its form. It appears with a large head, and a tail invested with hair, and moistened with an oleaginous liquor, which she makes use of as a cork to sustain her head in the air, and her tail in the water, and to transport her from one place to another. When the oil, with which her tail is moistened, begins to grow dry, she discharges out of her mouth an unctuous humour, which she sheds all over her tail, by virtue whereof she is enabled to transport herself where she pleases, without being either wet or anywise incommoded by the water. The gnat, in her second state, is, properly speaking, in her form a nymph, which is an introduction or entrance into a new life. In the first place, she divests herself of her second skin; in the next, she resigns her eyes, her antennæ, and her tail; in short, she actually seems to expire. However, from the spoils of the amphibious animal, a little winged insect cuts the air, whose every part is active to the last degree, and whose whole structure is the just object of our admiration. Its little head is adorned with a plume of feathers, and its whole body invested with scales and hair, to secure it from any wet or dust. She makes trial of the activity of her wings, by rubbing them either against her body, or her broad side-bags, which keep her in an equilibrium. The furbelow, or little border of fine feathers, which graces her wings, is very curious, and strikes the eye in the most agreeable manner. There is nothing, however, of greater importance to the gnat than her trunk, and that weak implement may justly be

hundred and fifty eggs, which, when all laid, float on the water secure from sinking, and are finally abandoned by the mother. They are hatched in a few days, the grubs issuing from the lower end; but the boat, now composed of the empty shells, continues to float till it is destroyed by the weather. Kirby justly describes this little vessel as resembling a London wherry, being sharp, and higher, as sailors say, *fore and aft*, convex below and concave above, and always floating on its keel. 'The most violent agitation of the water,' he adds, 'cannot sink it, and what is more extraordinary, and a property still a desideratum in our life-boats, though hollow, it never becomes filled with water, even though exposed. To put this to the test, I placed half a dozen of these boats upon the surface of a tumbler half-full of water: I then poured upon them a stream of that element from the mouth of a quart bottle held a foot above them. Yet after this treatment, which was so rough as actually to project one out of the glass, I found them floating as before upon their bottoms, and not a drop of water within their cavity.' We have repeatedly pushed them to the bottom of a glass of water; but they always came up immediately to the surface apparently unwetted." —*Insect Transformations.*

deemed one of nature's master-pieces. It is so very small, that the extremity of it can scarcely be discerned through the best microscope that can be procured. That part which is at first obvious to the eye is nothing but a long scaly sheath under the throat. At near the distance of two-thirds of it, there is an aperture, through which the insect darts out four stings, and afterwards retracts them. One of which, however sharp and active it may be, is no more than the case in which the other three lie concealed, and run in a long groove. The sides of these stings are sharpened like two-edged swords; they are likewise barbed, and have a vast number of cutting teeth towards the point, which turns up like a hook, and is fine beyond expression. When all these darts are stuck into the flesh of animals, sometimes one after another, and sometimes all at once, the blood and humours of the adjacent parts must unavoidably be extravasated; upon which a tumour must consequently ensue, the little orifice whereof is closed up by the compression of the external air. When the gnat, by the point of her case, which she makes use of as a tongue, has tasted any fruit, flesh, or juice, that she has found out; if it be a fluid, she sucks it up, without playing her darts into it; but in case she finds the least obstruction by any flesh whatever, she exerts her strength, and pierces through it, if possibly she can. After this she draws back her stings into her sheath, which she applies to the wound, in order to extract, as through a reed, the juices which she finds enclosed. This is the implement with which the gnat performs her work in the summer, for during the winter she has no manner of occasion for it. Then she ceases to eat, and spends all that tedious season either in quarries or in caverns, which she abandons at the return of summer, and flies about in search after some commodious ford, or standing water, where she may produce her progeny, which would be soon washed away and lost, by the too rapid motion of any running stream. The little brood are sometimes so numerous, that the very water is tinged according to the colour of the species, as green, if they be green, and of a sanguine hue, if they be red.

These are circumstances sufficiently extraordinary in the life of this little animal; but it offers something still more curious in the mode of its propagation. However similar insects of the gnat kind are in their appearance, yet they differ widely from each other in the manner in which they are brought forth, for some are oviparous, and are produced from eggs; some are viviparous, and come forth in their most perfect form; some are males, and unite with the female; some are females, requiring the impregnation of the male; some are of neither sex, yet still produce young without any copulation whatsoever. This is one of the strangest discoveries in all natural history! A gnat separated from

the rest of its kind, and enclosed in a glass vessel, with air sufficient to keep it alive, shall produce young, which also, when separated from each other, shall be the parents of a numerous progeny. Thus, down for five or six generations, do these extraordinary animals propagate without the use of copulation, without any congress between the male and the female, but in the manner of vegetables, the young bursting from the body of their parent, without any previous impregnation. At the sixth generation, however, their propagation stops; the gnat no longer produces its like, from itself alone, but it requires the access of the male to give it another succession of fecundity.

The gnat of Europe gives but little uneasiness; it is sometimes heard to hum about our beds at night, and keeps off the approaches of sleep by the apprehension it causes; but it is very different in the ill-peopled regions of America, where the waters stagnate, and the climate is warm, and where they are produced in multitudes beyond expression. The whole air is there filled with clouds of those famished insects, and they are found of all sizes, from six inches long, to a minuteness that even requires the microscope to have a distinct perception of them. The warmth of the mid-day sun is too powerful for their constitutions; but when the evening approaches, neither art nor flight can shield the wretched inhabitants from their attacks; though millions are destroyed, still millions more succeed, and produce unceasing torment. The native Indians, who anoint their bodies with oil, and who have from their infancy been used to their depredations, find them much less inconvenient than those who are newly arrived from Europe; they sleep in their cottages covered all over with thousands of the gnat kind upon their bodies, and yet do not seem to have their slumbers disturbed by their cruel devourers. If a candle happens to be lighted in one of those places, a cloud of insects at once light upon the flame, and extinguish it: they are therefore obliged to keep their candles in glass lanterns; a miserable expedient to prevent an unceasing calamity!

SUPPLEMENTARY NOTE.

Humboldt tells us, that "between the little harbour of Higuerote and the mouth of the Rio Unare, the wretched inhabitants, to protect themselves from the gnats, are accustomed to stretch themselves on the ground, and pass the night buried in the sand three or four inches deep, exposing only the head, which they cover with a handkerchief." Stedman also mentions, as a proof of the dreadful state to which he and his soldiers were reduced by them, that they were forced to sleep with their heads thrust into holes made into the earth with their bayonets, and their legs wrapped round with their hammocks. Mr. Churchill in his 'Memorials of Missionary Life in Nova Scotia' [London 1845], says: "I shall again ask the indulgence of the reader while I refer to another matter, which properly belongs to this place, because its novelty at the time was connected with the same journey, and though not of the

pleasing character, as a peculiarity, it is not less worthy of notice. I allude to the plague of the mosquito. On returning from Pietou to Truro in the stage, after a weary day's journey, we arrived in the latter place late in the evening, and as our party occupied the whole vehicle, to avoid the necessity of hastening our journey in the heat of the day, we proposed to make a very early start the following morning; accordingly we were on our journey as early as half-past two A. M. It was a mild moist summer's morning, in the third week of June, and our conversation appeared to turn naturally upon the subject of mosquito invasion, for our road lay through a level swampy country, the very place for the insect's wildest ravages. One of our little company had been narrating his sufferings in Newfoundland on one occasion from the same cause, and his account had its effect upon me to make me dread the impending storm, but in this instance my imagination had not outstripped the reality. As day dawned, the Philistines were upon us, our enemies were numerous and they were lively. I had never felt their sting before, but the recollection of that morning does not fade; had there been on their part as on ours a simultaneous annual convention, surely we had arrived at the very time of business. For nearly six hours our conversation was restricted to notes of exclamation; cloud after cloud of the invaders entered the open stage; our hands were incessantly employed; our foreheads, faces, head, and hands, every accessible part was assailed without mercy; it was no bloodless war; putting our foes to flight was no conquest; neutrality was impossible, and we were compelled to the encounter until the violence of the attack abated on our reaching higher ground. Our friend from Newfoundland hesitated not to admit his former experience was imperfect, and I was so thoroughly tired, that I tied my head over with a handkerchief, and sunk on the rough mail-bags at our feet, to seek some relief in broken and disturbed slumbers. "The gnats in America," says Mouffet, "do so plash and cut, that they will pierce through very thick clothing; so that it is excellent sport to behold how ridiculously the barbarous people, when they are bitten, will skip and frisk, and slap with their hands their thighs, buttocks, shoulders, arms, and sides, even as a carter doth his horses." Weld tells us that "these insects were so powerful and blood-thirsty, that they actually pierced through General Washington's boots." This does not appear very creditable, though Mouffet says, "In Italy, near the Po, great store, and very great ones are to be seen, terrible for biting, and venomous, *piercing through a thrice-doubled stocking, and boots likewise*; sometimes leaving behind them impositions, hard, blue tumours, sometimes painful bladders, sometimes itching pimples, such as Hippocrates hath observed in his Epidemics, in the body of one Cyrus, a fuller, being frantic." When we consider these circumstances, we cannot justly discredit that they attacked so fiercely the army of Julian the Apostate as to drive him back; or that Sapor, king of Persia, as reported, should have been compelled to raise the siege of Nisibis by a plague of gnats, which, attacking his elephants and beasts of burden, so caused the rout of his army.

At Oxford, during the summer of 1766, gnats were sometimes seen towards evening in such myriads as literally to darken the rays of the sun. Mr. Swinton mentions, that one evening, about half an hour before sunset, he was in the garden of Wadham College, when he saw six columns of them ascending from the boughs of an apple-tree, some in a perpendicular, others in an oblique direction, to the height of fifty or sixty feet. Their bite was attended with violent inflammation, and when one was killed after it had bit, the blood contained in it would cover three or four inches of wall. About thirty years before this,

vast columns of gnats were seen to rise in the air from Salisbury cathedral, resembling, at a distance, columns of smoke, which made the people imagine the edifice was on fire. At Sagan, in Silesia, in July, 1812, a similar occurrence gave rise in like manner to an alarm that the church was on fire. The poet Spenser says, the Irish "goe all naked except a mantle, which is a fit house for an outlaw—a meet bed for a rebel—and an apt cloak for a thief. It coucheth him strongly against the gnats, which, in that country, doe more to annoy the naked rebels, and doe more sharply wound them, than all their enemies' swords and speares, which can seldom come nigh them."

It is worthy of remark that a numerous family are confounded under the common names of gnat and mosquito, as if there were only one or two species; whereas Mr. Stephens has enumerated twenty-two species of the genera *Culex* and *Anopheles*, found in Britain alone; and hence it is probable, the foreign mosquitoes are also of several species, though to common observers they do not appear to differ from the common gnat.

The *Musquito-fly* is very common in the woody and marshy parts of all hot climates. It also abounds, during their short summer, throughout Lapland, Norway, and Finland, and other countries equally near the pole. The female bites, and sucks the blood in such a severe manner, as to swell and blister the skin very severely, and sometimes leave obstinate sores. These insects are found in such swarms in the woods, that whoever enters them is sure to have his face covered, and he is scarcely able to see his way before him. A swelling and disagreeable itch instantly follows the puncture, and these are succeeded by small white ulcers; so that the face of a person coming from the country is scarcely to be recognised, and it appears full of blotches. Even gloves are not always found a protection against these troublesome insects, as they often pass their stings through the seams. It is the female only that bites; the buzzing, however, of both males and females is so very loud, as to be alone sufficient to disturb the rest of persons at night.

The *Ox Gad-fly* has brown unspotted wings; and the abdomen is marked with a black band in the middle, and has dusky yellow hairs at the tip. The front is white, and covered with down; and the thorax is yellowish before, black in the middle, and cinereous behind. The female differs from the male in having a black style at the end of the abdomen. This insect deposits its eggs in the back of the ox, and the larvæ live beneath the skin, between this and the cellular membrane. Its sac or abscess is somewhat larger than the insect, and by narrowing upwards, it opens externally to the air by a small aperture.

When young the larva is smooth, white, and transparent; but, when full grown, is of a deep brown. It is also supplied, in this state, with innumerable minute hooks, ranged in contrary directions on its body, with which, by occasionally erecting or depressing them, it is moved about in the abscess; and from this motion, and the consequent irritation, a more or less copious secretion of pus takes place for its sustenance. As soon as the larva is full grown, it effects its escape from the abscess by pressing against the external opening. When this becomes of sufficient size, it writhes itself through, and falls from the back of the animal to the ground; and, seeking for a convenient place, becomes a chrysalis. After the exit of the larva, the wound in the skin is generally closed up and healed in a few days. When the perfect insect leaves the chrysalis, it forces open a very considerable margined triangular lid, which is situated on one side of the small end. This insect is the largest of the European species, and

is very beautiful: it is, however, the terror of cattle, as it inflicts great pain when depositing its eggs.

The *Horse Gad-fly* is distinguished from the rest of its tribe by having a black band in the middle and two dots at the tip of its whitish wings. The abdomen is yellow brown, with black spots at the divisions of the segments. The female is more brown than the male, and has her abdomen elongated with a cleft terminal style. The larvæ are those odd-looking grubs which are commonly found in the stomachs of horses, and sometimes, though much less frequently, in the intestines. Here they hang in

clusters of from half-a-dozen to more than a hundred, adhering to the inner membrane of the stomach, by means of two small hooks or tentaculae at their heads, whose points turn outward. When they are removed from the stomach, they will attach themselves to any loose membrane, even to the skin of the hand. To effect this they draw back their hooks, which have a joint near their base, almost entirely within their skin, till the two points come close to each other; then, keeping them parallel, they pierce through the membrane, and immediately afterwards expand in a lateral direction; and by these means they become perfectly fixed.

BOOK V.

OF THE ZOOPHYTES.

CHAP. I.

OF ZOOPHYTES IN GENERAL.

WE now come to the last link in the chain of animated nature, to a class of beings so confined in their powers, and so defective in their formation, that some historians have been at a loss whether to consider them as a superior rank of vegetables, or the humblest order of the animated tribe. In order, therefore, to give them a denomination agreeable to their existence, they have been called Zoophytes, a name implying vegetable nature endued with animal life; and, indeed, in some the marks of the animal are so few, that it is difficult to give their place in nature with precision, or to tell whether it is a plant or an insect that is the object of our consideration.

Should it be asked what it is that constitutes the difference between animal and vegetable life; what it is that lays the line that separates those two great kingdoms from each other, it would be difficult, perhaps we should find it impossible, to return an answer. The power of motion cannot form this distinction, since some vegetables are possessed of motion, and many animals are totally without it. The sensitive plant has obviously a greater variety of motions than the oyster or the pholas. The animal that fills the acorn-shell is immovable, and can only close its lid to defend itself from external injury, while the flower, which goes by the name of the fly-trap, seems to close upon the flies that light upon it, and that attempt to rifle it of its honey. The animal in this instance seems to have scarce a power of self-defence; the vegetable not only guards its possessions, but seizes upon the robber that would venture to invade them. In like manner, the methods of propagation give no superiority to the lower rank of animals. On

the contrary, vegetables are frequently produced more conformably to the higher ranks of the creation; and though some plants are produced by cutting from others, yet the general manner of propagation is from seeds, laid in the womb of the earth, where they are hatched into the similitude of the parent plant or flower. But a most numerous tribe of animals have lately been discovered, which are propagated by cutting, and this in so extraordinary a manner, that, though the original insect be divided into a thousand parts, each, however small, shall be formed into an animal, entirely resembling that which was at first divided; in this respect, therefore, certain races of animals seem to fall beneath vegetables, by their more imperfect propagation.¹

¹ The reasoning held forth by our author is more chimerical than just. Although naturalists have found some difficulty in arranging, in their proper place in the system of nature, various species of zoophytes, yet there could be but few doubts as to where the different species of testaceous shells should be placed. Although all the species of *lepas*, or acorn-shells, are incapable of roaming about in search of food, being always parasitical, and immovably fixed to some other substance; yet they are possessed of powers of voluntary motion, which must at once distinguish them from vegetables. They have feelers which they can protrude in search of food, and which they can extend or withdraw at pleasure. The oyster and pholas hold still a higher rank in the scale of beings: the former of which is independent, and can move about at pleasure; while the pholas, although generally confined within a small cavity, which it makes for itself in stone or hard clay, and which it can enlarge at pleasure, has also the power of moving its whole shell, and of protruding a long prehensile tube in search of food.

The creatures that are ranked under the Linnæan order *zoophyta* seem to hold a middle station between animals and vegetables. Most of them, deprived of the powers of locomotion, are fixed by stems that take root in crevices of rocks, and among sand: these by degrees send off branches, till at

What, therefore, is the distinction between them?—or are the orders so intimately blended as that it is impossible to mark the boundaries of each? To me it would seem, that all animals are possessed of one power, of which vegetables are totally deficient; I mean, either the actual ability, or an awkward attempt at self-preservation. However vegetables may seem possessed of this important quality, yet it is with them but a mechanical impulse, resembling the raising one end of the lever when you depress the other; the sensitive plant contracts and hangs its leaves, indeed, when touched, but this motion no way contributes to its safety: the fly-trap flower acts entirely in the same manner; and though it seems to seize the little animal that comes to annoy it, yet, in reality, only closes mechanically upon it, and this enclosure neither contributes to its preservation nor its defence. But it is very different with insects, even of the lowest order; the earth-worm not only contracts, but hides itself in the earth, and escapes with some share of swiftness from its pursuers. The polypus hides its horns; the star-fish contracts its arms upon the appearance even of distant dangers; they not only hunt for their food, but provide for their safety; and however imperfectly they may be formed, yet still they are in reality placed many degrees above the highest vegetable of the earth, and are possessed of many animal functions, as well as those that are more elaborately formed.

But though these be superior to plants, they are far beneath their animated fellows of existence. In the class of zoophytes, we may place all those animals which may be propagated by cuttings; or in other words, which, if divided into two or more parts, each part in time becomes a separate and perfect animal; the head shoots forth a tail, and, on the contrary, the tail produces a head; some of these will bear dividing but into two parts, such as the earth-worm; some may be divided into more than two, and of this kind are many of the star-fish; others still may be cut into a thousand parts, each becoming a perfect animal; they may be turned inside out, like the finger of a glove; they may be moulded into all manner of shapes, yet still their vivacious principle remains, still every single

length some of them attain the size and extent of large shrubs. The zoophytes are usually considered under two divisions. The stony branches of the first division, which has the general appellation of *coral*, are hollow, and full of cells, which are the habitations of animals resembling polypes, medusæ, &c., according to their respective genera. The next division consists of such animals as have softer stems, and are in general not merely inhabitants of a stem or branches, but are themselves in the form of a plant. Those of this division which are best known, are the corallines, the sponges, and the polypes.

The animals which inhabit the madrepores are medusæ. The coral which contains them is fixed and simple, or branched, with cavities composed of lamellæ in a star-like form.—ED.

part becomes perfect in its kind, and, after a few days' existence, exhibits all the arts and industry of its contemptible parent! We shall, therefore, divide zoophytes according to their several degrees of perfection, namely, into worms, star-fish, and polypi; contenting ourselves with a short review of those nauseous and despicable creatures, that excite our curiosity chiefly by their imperfections; it must not be concealed, however, that much has of late been written on this part of natural history. A new mode of animal production, could not fail of exciting not only the curiosity, but the astonishment of every philosopher: many found their favourite systems totally overthrown by the discovery; and it was not without a wordy struggle, that they gave up what had formerly been their pleasure and their pride. At last, however, conviction became too strong for argument; and a question, which owed its general spread rather to its novelty than to its importance, was given up in favour of the new discovery.

SUPPLEMENTARY NOTE.

Dr. George Johnston, in his recent work on British Zoophytes, restricting the term *zoophyte* to those creatures "which in their form, or most remarkable characters, recall the appearance of a vegetable or its leading properties," defines the class thus:—Animals avertebrate, inarticulate, soft, irritable and contractile, without a vascular or separate respiratory or nervous system; mouth superior, central, circular, edentulous, surrounded by tubular, or more commonly by filiform tentacula; alimentary canal variable; where there is an intestine the anus opens near the mouth; asexual; gemmiparous; aquatic. The individuals (*polypes*) of a few families are separate and perfect in themselves, but the greater number of zoophytes are compound beings, viz., each zoophyte consists of an indefinite number of individuals or polypes, organically connected and placed in a calcareous, horny, or membranous case or cells, forming, by their aggregation, corals or plant-like polypidoms. The arrangement which he adopts, or rather elaborates, is as follows.

Subclass I. RADIATED ZOOPHYTES. Body contractile in every part, symmetrical; mouth and anus one; gemmiparous and oviparous.

Order I. Hydroida. Polypes compound, the mouth encircled with roughish filiform tentacula; stomach without proper parietes; reproductive gemmules pullulating from the body and naked, &c.

Order II. Asteroïda. Polypes compound, the mouth encircled with eight fringed tentacula; stomach membranous, with dependent vasculiform appendages; reproductive gemmules produced interiorly, &c.

Order III. Helianthoida. Polypes single, free or permanently attached, fleshy, naked, or encrusted with a calcareous polypidom, the upper surface of which is crossed with radiating lamellæ; mouth encircled with tubulous tentacula; stomach membranous, plaited, oviparous, &c.

Subclass II. MOLLUSCAN ZOOPHYTES. Body non-contractile, and non-symmetrical; mouth and anus separate; gemmiparous and oviparous.

Order IV. Ascidioida. Polypes aggregate, the mouth encircled with filiform ciliated retractile tentacula; a distinct stomach, with a curved intestine terminating in an anus near the mouth; ova internal. Polypidom horny and fistulous, or calcareous, membranous, &c.

CHAP. II.

OF WORMS.

THE first in the class of zoophytes, are animals of the worm kind, which, being entirely destitute of feet, trail themselves along upon the ground, and find themselves a retreat under the earth, or in the water. As these, like serpents, have a creeping motion, so both, in general, go under the common appellation of reptiles; a loathsome, noxious, malignant tribe, to which man by nature, as well as by religion, has the strongest antipathy. But though worms, as well as serpents, are mostly without feet, and have been doomed to creep along the earth on their bellies, yet their motions are very different. The serpent, as has been said before, having a back-bone, which it is incapable of contracting, bends its body into the form of a bow, and then shoots forward from the tail; but it is very different with the worm, which has a power of contracting or lengthening itself at will. There is a spiral muscle, that runs round its whole body, from the head to the tail, somewhat resembling a wire wound round a walking-cane, which when slipped off, and one end extended and held fast, will bring the other nearer to it; in this manner the earth-worm, having shot out, or extended its body, takes hold by the slime of the forepart of its body, and so contracts and brings forward the hinder part; in this manner it moves onward, not without great efforts; but the occasions for its progressive motions are few.

As it is designed for living under the earth, and leading a life of obscurity, so it seems tolerably adapted to its situation. Its body is armed with small stiff sharp burrs or prickles, which it can erect or depress at pleasure; under the skin there lies a slimy juice, to be ejected as occasion requires, at certain perforations between the rings of the muscles, to lubricate its body, and facilitate its passage into the earth. Like most other insects, it has breathing holes along the back, adjoining each ring; but it is without bones, without eyes, without ears, and properly without feet. It has a mouth, and also an alimentary canal, which runs along to the very point of the tail. In some worms, however, particularly such as are found in the bodies of animals, this canal opens towards the middle of the belly, at some distance from the tail. The intestines of the earth-worm are always found filled with a very fine earth, which seems to be the only nourishment these animals are capable of receiving.

The animal is entirely without a brain, but near the head is placed the heart, which is seen to beat with a very distinct motion, and round it are the spermatic vessels, forming a number of little globules, containing a milky fluid, which have an opening into the belly not far from the

head; they are also often found to contain a number of eggs, which are laid in the earth, and are hatched in twelve or fourteen days into life, by the genial warmth of their situation; like snails, all these animals unite in themselves both sexes at once; the reptile that impregnates, being impregnated in turn: few that walk out, but must have observed them, with their heads laid against each other, and so strongly attached, that they suffer themselves to be trode upon.

When the eggs are laid in the earth, which, in about fourteen days, as has been said, are hatched into maturity, the young ones come forth very small but perfectly formed, and suffer no change during their existence; how long their life continues is not well known, but it certainly holds for more than two or three seasons. During the winter, they bury themselves deeper in the earth, and seem, in some measure, to share the general torpidity of the insect tribe. In spring, they revive with the rest of nature, and on those occasions, a moist or dewy evening brings them forth from their retreats, for the universal purpose of continuing their kind. They chiefly live in a light, rich, and fertile soil, moistened by dews or accidental showers, but avoid those places where the water is apt to lie on the surface of the earth, or where the clay is too stiff for their easy progression under ground.

Helpless as they are formed, yet they seem very vigilant in avoiding those animals that chiefly make them their prey; in particular, the mole, who feeds entirely upon them beneath the surface, and who seldom ventures, from the dimness of its sight, into the open air; him they avoid, by darting up from the earth the instant they feel the ground move; and fishermen, who are well acquainted with this, take them in what numbers they choose, by stirring the earth where they expect to find them. They are also driven from their retreats under ground, by pouring bitter or acrid water thereon, such as that water in which green walnuts have been steeped, or a ley made of potashes.

Such is the general outline of the history of these reptiles, which, as it should seem, degrades them no way beneath the rank of other animals of the insect creation: but now we come to a part of their history which proves the imperfection of their organs, from the easiness with which these little machines may be damaged and repaired again. It is well known in mechanics, that the finest and most complicated instruments are the most easily put out of order, and the most difficultly set right; the same also obtains in the animal machine. Man, the most complicated machine of all others, whose nerves are more numerous, and powers of action more various, is most easily destroyed; he is seen to die under wounds which a quadruped or bird could easily survive; and as we descend gradually to the lower ranks, the ruder the composition the more difficult it is to disarrange it. Some ani-

mals live without their limbs, and often are seen to reproduce them; some are seen to live without their brain for many weeks together; caterpillars continue to increase and grow large, though all their nobler organs are entirely destroyed within; some animals continue to exist, though cut in two, their nobler parts preserving life, while the others perish that were cut away; but the earth-worm, and all the zoophyte tribe, continue to live in separate parts, and one animal, by the means of cutting, is divided into two distinct existences, sometimes into a thousand!

There is no phenomenon in all natural history more astonishing than this, that man at pleasure should have a kind of creative power, and out of one life make two, each completely formed, with all its apparatus and functions; each with its perceptions, and powers of motion and self-preservation; each as complete in all respects as that from which it derived its existence, and equally enjoying the humble gratifications of its nature.

When Des Cartes first started the opinion, that brutes were machines, the discovery of this surprising propagation was unknown, which might, in some measure, have strengthened his fanciful theory. What is life in brutes? he might have said, or where does it reside? In some we find it so diffused, that every part seems to maintain a vivacious principle, and the same animal appears possessed of a thousand distinct irrational souls at the same time. But let us not, he would say, give so noble a name to such contemptible powers, but rank the vivifying principle in these with the sap that rises in vegetables, or the moisture that contracts a cord, or the heat that puts water into motion! Nothing, in fact, deserves the name of soul, but that which reasons, that which understands, and by knowing God, receives the mark of its currency, and is minted with the impression of its great Creator.

Such might have been the speculations of this philosopher: however, to leave theory, it will be sufficient to say, that we owe the first discovery of this power of reproduction in animals to Mr. Trembley, who first observed it in the Polypus, and after him, Spalanzani and others found it taking place in the earth-worm, the sea-worm, and several other ill-formed animals of a like kind, which were susceptible of this new mode of propagation. This last philosopher has tried several experiments upon the earth-worm, many of which succeeded according to his expectation: every earth-worm, however, did not retain the vivacious principle with the same obstinacy; some, when cut in two, were entirely destroyed; others survived only in the nobler part; and while the head was living, the tail entirely perished, and a new one was seen to bourgeon from the extremity. But what was most surprising of all, in some, particularly in the small red-headed earth-worm, both extremities survived the operation; the head produced a tail, with

the anus, the intestines, the annular muscle, and the prickly beards; the tail part, on the other hand, was seen to shoot forth the nobler organs, and in less than the space of three months sent forth a head, a heart, with all the apparatus and instruments of generation. This part, as may easily be supposed, was produced much more slowly than the former, a new head taking above three or four months for its completion; a new tail being shot forth in less than as many weeks. Thus two animals, by dissection, were made out of one, each with their separate appetites, each endued with life and motion, and seemingly as perfect as that single animal from whence they derived their origin.

What was performed upon the earth-worm was found to obtain also in many of the vermicular species. The sea-worm, the white water-worm, and many of those little worms with feelers, found at the bottom of dirty ditches; in all these the nobler organs are of such little use, that if taken away, the animal does not seem to feel the want of them; it lives in all its parts, and in every part; and by a strange paradox in nature, the most useless and contemptible life is of all others the most difficult to destroy.

SUPPLEMENTARY NOTE.

Allied to these in their vermicular shape, are several other kinds of worms commonly known by the name of Thread-worms.—The *Common Hair-worm* is found in fresh waters, or in a wet clayey soil, through which it perforates. In size and appearance it exactly resembles the hair of a horse's tail; and when touched, twists itself into a variety of knot-like contortions, for which reason it has been called the Gordias.—The *Guinea-worm* is shaped like the Gordius, except that the mouth is dilated, and has a roundish concave lip. It enters the naked arms and legs of the inhabitants of the East and West Indies, sinking deep into the muscles, and frequently occasioning inflammation and fever.—The *Fury* is a still more dangerous worm, and has on each side a single row of closely pressed reflected prickles. It is found in Finland and the northern parts of Sweden, in marshy places, where it crawls up the stems of sedge-grass and low shrubs; and being wafted by the wind, darts into the naked parts of such as may happen to be near it. The celebrated naturalist, Sir Charles Linne, was so severely bitten by one of these dreadful animals, that for some time it was doubtful whether he would live or die.

The *Naked Tube worm* is elongated on the body; with a cylindrical mouth at the one end. The aperture at the side of the body is cruciform. The body of the naked tube worm is covered with a close skin, and globular at the lower end. It inhabits the European seas, under stones, and grows to eight inches in length.

The *Taenia*, or *Tape worms*, inhabit the bodies of different animals, where they are destined to feed upon the juices already animalized. They are generally found in the alimentary canal, and usually about the upper part of it, where there is the greatest abundance of chyle, which seems to be their natural food. We are not to suppose that these worms are created for the purpose of producing disease in the animals they inhabit, but rather that nature has directed that no situation should be vacant, where the work of multiplying the species of living beings could

be carried on. By thus allowing them to exist within each other, the sphere of increase is considerably enlarged. There is, however, little doubt, that worms, and more especially those of the present tribe, do sometimes produce diseases in the bodies they inhabit; but we are at the same time very certain, that worms do exist abundantly in many animals without at all disturbing their functions, or annoying them in the slightest degree: and we ought to consider all these creatures rather as the concomitants, than the causes of disease.

The *Common Tape worm* inhabits the intestines of mankind, generally at the upper part of the alimentary canal; it is from three to thirty feet in length, and has been found even sixty feet long. It is sometimes solitary, but generally in considerable numbers, and occasions emaciation and various distressing maladies. The head has a terminal mouth, surrounded with two rows of radiate hooks or holders; and a little beneath, on the flattened surface, it has four tuberculate orifices or suckers, two on each side. The body is composed of a number of distinct joints, appearing as if sheathed in each other; each joint with a lateral marginal pore, by which it attaches itself to the intestines; those near the head a little smaller, enlarging towards the middle, and gradually lessening towards the tail: the tail is terminated by a semicircular joint, without any aperture.

Upwards of 1,200 species of intestinal worms have been discovered. Sixteen of these have been found in the human body; the rest are peculiar to other animals.

CHAP. III.

OF THE STAR-FISH.

THE next order of zoophytes, is that of the star-fish, a numerous tribe, shapeless and deformed, assuming at different times different appearances. The same animal that now appears round like a ball, shortly after flattens as thin as a plate. All of this kind are formed of a semi-transparent gelatinous substance, covered with a thin membrane, and to an inattentive spectator often appear like a lump of inanimate jelly, floating at random upon the surface of the sea, or thrown by chance on shore at the departure of the tide.¹

¹ Our author has here confounded the actinæ, or sea anemones, with star-fish animals considerably different in their forms as well as functions. When we take a view of the lower orders of zoology, we find a large and singular set of beings, which are so widely distinct from the other tribes of the animal world, that they seem almost as nearly allied to vegetables as animals. Many of these curious productions of nature are arranged by Linnæus under the title of Mollusca; which title is one of the subdivisions of the Linnæan tribe of worms. Of the various genera belonging to the mollusca, or soft animals, that of the actinia is perhaps the most elegant and curious. Many species of this genus have been called by the name of sea anemones, from a general resemblance which they bear, during their expanded state, to that flower.

The *Anemone Actinia*, though extremely common on several of the European coasts, and on our own in particular, does not seem distinctly mentioned by Linnæus in the 'Systema Naturæ.' It adheres firmly to rocks, so as to be frequently left above water at

But upon a more minute inspection, they will be found possessed of life and motion; they will be found to shoot forth their arms in every direction, in order to seize upon such insects as are near, and to devour them with great rapacity. Worms, the spawn of fish, and even mussels themselves, with their hard resisting shell, have been found in the stomachs of these voracious animals; and what is very extraordinary, though the substance of their own bodies be almost as soft as water, yet they are no way injured by swallowing these shells, which are almost of a stony hardness. They increase in size as all other animals do. In summer, when the water of the sea is warmed by the heat of the sun, they float upon the surface, and in the dark they send forth a kind of shining light resembling that of phosphorus. Some have given these animals the name of sea-nettles, because they burn the hands of those that touch them, as nettles are found to do. They are often seen fastened to the rocks, and to the largest sea-shells, as if to derive their nourishment from them. If they be taken and put into spirit of wine, they will continue for many years entire; but if they be left to the influence of the air, they are, in less than four and twenty hours, melted down into limpid and offensive water.

In all of this species, none are found to possess a vent for their excrements; but the same passage by which they devour their food, serves for the ejection of their feces. These animals, as was said, take such a variety of figures, that it is impossible to describe them under one determinate shape; but in general their bodies resemble a truncated cone, whose base is applied to the rock to which they are found usually attached. Though generally transparent, yet they are found of different colours, some inclining to green, some to red, some to white, and some to brown. In some, their colours appear diffused over the whole surface, in some they are often streaked, and in others often spotted. They are possessed of a very slow progressive motion, and in fine weather they are continually seen, stretching out and fishing for their prey.² Many of them are pos-

the ebbing of the sea; but it is generally found adhering at some little depth below the surface of the water. Its general colour is deep red, more or less vivid in different specimens.

The *Funnel Medusa* is an elegant species of an oval form, which is to be found about the western islands of Jamaica.—ED.

² The *Asterias*, or *Star-fish* tribe are inhabitants of the sea; and are usually found on the sand, or among rocks on the sea shore, commonly below high water mark. They are a numerous tribe, and subject to great variety of form; and differ materially in the number and construction of their rays. The covering is a coriaceous crust, which defends them from the attacks of the smaller animals; and they have five or more rays proceeding from a centre, in which their mouth is situated. Every ray is furnished with a prodigious number of tentacles, or short, soft, and fleshy tubes, which appear to be of use not only in taking prey, and in aiding the notice

sessed of a number of long slender filaments, in which they entangle any small animals they happen to approach, and thus draw them into their enormous stomachs, which fill the whole cavity of their bodies. The harder shells continue for some weeks undigested, but at length they undergo a kind of maceration in the stomach, and become a part of the substance of the animal itself. The indigestible parts are returned by the same aperture by which they were swallowed, and then the star-fish begins to fish for more. These also may be cut in pieces, and every part will survive the operation; each becoming a perfect animal, endued with its natural rapacity. Of this tribe, the number is various, and the description of each would be tedious and uninteresting; the manners and nature of all are nearly as described; but I will just make mention of one creature, which, though not properly belonging to this class, yet is so nearly related, that the passing it in silence would be an unpardonable omission.

Of all other animals, the cuttle-fish, though in some respects superior to this tribe, possesses qualities the most extraordinary, it is about two feet long, covered with a very thin skin, and its flesh composed of a gelatinous substance, which, however, within-side, is strengthened by a strong bone, of which such great use is made by the goldsmith. It is possessed of eight arms, which it extends, and which are probably of service to it in fishing for its prey: while in life, it is capable of lengthening or contracting these at pleasure; but when dead, they contract, and lose their rigidity. They feed upon small fish, which they seize with their arms; and they are bred from eggs, which are laid upon the weeds along the sea-shore.³

of the animal, but also in enabling it to adhere to rocks and other substances, by which it withstands the force of the waves. In a single animal the tentaculæ have been found several hundred in number; and, when the star-fish are thrown on their backs, these may be observed to be pushed out and withdrawn, in the same manner as snails do their horns. The progressive motion of the star-fish, which is performed by the undulation of their rays, is very slow. They possess considerable powers of reproduction; for if a ray be broken off, in the course of a short time a new one will appear.

The *Hairy Asteria*, or *Star-fish*, is not uncommon on the coasts of Great Britain. The animal is coriaceous, with acute angles, and hairy. The rays are five in number, broad, and angulated at top; rough, with short bristles: its colour is brown. This species is common at Anglesea.—Ed.

³ Of this genus eight species have been discovered. The structure of these animals is very remarkable. The body is cylindrical, and in some of the species entirely covered with a fleshy sheath; in others the sheath reaches only to the middle of the body. They have eight tentaculæ or arms, and in general two feelers, as they are called, which are much longer than the arms. Both the feelers and arms are furnished with strong circular cups or suckers. The mouth of these animals is hard, strong, and horny, resembling, both in texture and substance, the beak

The cuttle-fish is found along many of the coasts of Europe, but are not easily caught, from a contrivance with which they are furnished by nature; this is a black substance, of the colour of ink, which is contained in a bladder generally on the left side of the belly, and which is ejected in the manner of an excrement from the anus. Whenever, therefore, this fish is pursued, and when it finds a difficulty of escaping, it spurts forth a great quantity of this black liquor, by which the waters are totally darkened, and then it escapes by lying close at the bottom. In this manner the creature finds its safety; and men find ample cause for admiration, from the great variety of stratagems with which creatures are endued for their peculiar preservation.

CHAP. IV.

OF THE POLYPUS.

THOSE animals which we have described in the last chapter are variously denominated. They have been called the *Star-fish*, *Sea-nettles*, and *Sea-polypi*. This last name has been peculiarly ascribed to them by the ancients, because of the number of feelers or feet of which they are all possessed, and with which they have a slow progressive motion; but the moderns have given the name of *Polypus* to a reptile that lives in fresh water, by no means so large or observable. These are found at the bottom of wet ditches, or attached to the under surface of the broad-leaved plants that grow and swim on the waters. The same difference holds between these and the sea-water polypus, as between all the productions of the sea, and of the land and the ocean. The marine vegetables and animals grow to a monstrous size. The eel, the pike, or the bream, of fresh waters is but small; but in the sea they grow to an enormous magnitude. The herbs of the field are at most but a few feet high; those of the sea often shoot forth a stalk of a hundred. It is so between the polypi of both elements. Those of the sea are found from two feet in length to three or four, and Pliny has even described one, the arms of which were no less than thirty feet long. Those in fresh waters, however, are comparatively minute; at their utmost size seldom above three parts of an inch long, and when gathered up into their usual form, not above a third even of those dimensions.

It was upon these minute animals that the power of dissection was first tried in multiplying their numbers. They had been long considered as little worthy the attention of observers, and

of a parrot. In hot climates, the cuttle-fish sometimes becomes of such a size as to measure twelve feet across the centre, and to have each of its arms between forty and fifty feet long. The Indians are sometimes clasped in their canoes by them.—Ed.

were consigned to that neglect in which thousands of minute species of insects remain to this very day. It is true, indeed, that Reaumur observed, classed, and named them. By contemplating their motions, he was enabled distinctly to pronounce on their being of the animal and not of the vegetable kingdom; and he called them *polypi*, from their great resemblance to those larger ones that were found in the ocean. Still, however, their properties were neglected, and their history unknown.

Mr. Trembley was the person to whom we owe the first discovery of the amazing properties and powers of this little vivacious creature. He divided this class of animals into four different kinds: into those inclining to green, those of a brownish cast, those of a flesh-colour, and those which he calls the *polype de panache*. The differences of structure in these, as also of colour, are observable enough; but the manner of their subsisting, of seizing their prey, and of their propagation, is pretty nearly the same in all.

Whoever has looked with care into the bottom of a wet ditch when the water is stagnant, and the sun has been powerful, may remember to have seen many little transparent lumps of jelly, about the size of a pea, and flatted on one side; such also as have examined the under side of the broad-leaved weeds that grow on the surface of the water, must have observed them studded with a number of these little jelly-like substances, which were probably then disregarded, because their nature and history were unknown. These little substances, however, were no other than living *polypi*, gathered up into a quiescent state, and seemingly inanimate, because either undisturbed, or not excited by the calls of appetite to action. When they are seen exerting themselves, they put on a very different appearance from that when at rest: to conceive a just idea of their figure, we may suppose the finger of a glove cut off at the bottom; we may suppose also several threads or horns planted round the edge like a fringe. The hollow of this finger will give us an idea of the stomach of the animal; the threads issuing forth from the edges may be considered as the arms or feelers with which it hunts for its prey. The animal, at its greatest extent, is seldom seen above an inch and a half long, but it is much shorter when it is contracted and at rest; it is furnished neither with muscles nor rings, and its manner of lengthening or contracting itself more resembles that of the snail, than worms, or any other insect. The *polypus* contracts itself more or less, in proportion as it is touched, or as the water is agitated in which they are seen. Warmth animates them, and cold benumbs them; but it requires a degree of cold approaching congelation before they are reduced to perfect inactivity; those of an inch long have generally their arms double, often thrice as long as their bodies. The arms, where the animal is not disturbed, and the season not unfavourable,

are thrown about in various directions, in order to seize and entangle its little prey; sometimes three or four of the arms are thus employed, while the rest are contracted like the horns of a snail, within the animal's body. It seems capable of giving what length it pleases to these arms; it contracts and extends them at pleasure, and stretches them only in proportion to the remoteness of the object it would seize.

These animals have a progressive motion, which is performed by that power they have of lengthening and contracting themselves at pleasure; they go from one part of the bottom to another; they mount along the margin of the water, and climb up the side of aquatic plants. They often are seen to come to the surface of the water, where they suspend themselves by their lower end. As they advance but very slowly, they employ a great deal of time in every action, and bind themselves very strongly to whatever body they chance to move upon as they proceed; their adhesion is voluntary, and is probably performed in the manner of a cupping-glass applied to the body.

All animals of this kind have a remarkable attachment to turn towards the light; and this naturally might induce an inquirer to look for their eyes; but however carefully this search has been pursued, and however excellent the microscope with which every part was examined, yet nothing of the appearance of this organ was found over the whole body; and it is most probable that, like several other insects which hunt their prey by their feeling, these creatures are unfurnished with advantages which would be totally useless for their support.

In the centre of the arms, as was said before, the mouth is placed, which the animal can open and shut at pleasure, and this serves at once as a passage for food, and an opening for it after digestion. The inward part of the animal's body seems to be one great stomach, which is open at both ends; but the purposes which the opening at the bottom serves are hitherto unknown, but certainly not for excluding their excrements, for those are ejected at the aperture by which they are taken in. If the surface of the body of this little creature be examined with a microscope, it will be found studded with a number of warts, as also the arms, especially when they are contracted; and these tubercles, as we shall presently see, answer a very important purpose.

If we examine their way of living, we shall find these insects chiefly subsisting upon others, much less than themselves, particularly a kind of millepedes that live in the water, and a very small red worm, which they seize with great avidity. In short, no insect whatsoever, less than themselves, seems to come amiss to them; their arms, as was observed above, serve them as a net would a fisherman, or perhaps, more exactly speaking, as a lime-twigg does a fowler.

Wherever their prey is perceived, which the

animal effects by its feeling, it is sufficient to touch the object it would seize upon, and it is fastened without a power of escaping. The instant one of this insect's long arms is laid upon a millepede, the little insect sticks without a possibility of retreating. The greater the distance at which it is touched, the greater is the ease with which the polypus brings the prey to its mouth. If the little object be near, though irretrievably caught, it is not without great difficulty that it can be brought to the mouth and swallowed. When the polypus is unsupplied with prey, it testifies its hunger by opening its mouth; the aperture, however, is so small that it cannot be easily perceived; but when, with any of its long arms, it has seized upon its prey, it then opens the mouth distinctly enough, and this opening is always in proportion to the size of the animal which it would swallow; the lips dilate insensibly by small degrees, and adjust themselves precisely to the figure of their prey. Mr. Trembley, who took a pleasure in feeding this useless brood, found that they could devour aliments of every kind, fish and flesh, as well as insects; but he owns they did not thrive so well upon beef and veal, as upon the little worms of their own providing. When he gave one of these famished reptiles any substance which was improper to serve for aliment, at first it seized the prey with avidity, but after keeping it sometime entangled near the mouth, it dropt it again with distinguishing nicety.

When several polypi happen to fall upon the same worm, they dispute their common prey with each other. Two of them are often seen seizing the same worm at different ends, and dragging it at opposite directions with great force. It often happens, that while one is swallowing its respective end, the other is also employed in the same manner, and thus they continue, swallowing each his part, until their mouths meet together; they then rest, each for some time in this situation, till the worm breaks between them, and each goes off with his share; but it often happens that a seemingly more dangerous combat ensues, when the mouths of both are thus joined upon one common prey together; the largest polypus then gapes and swallows his antagonist; but what is very wonderful, the animal thus swallowed seems to be rather a gainer by the misfortune. After it has lain in the conqueror's body for about an hour, it issues unhurt, and often in possession of the prey which had been the original cause of contention. How happy would it be for men if they had as little to fear from each other!

These reptiles continue eating the whole year, except when the cold approaches to congelation; and then, like most others of the insect tribe, they feel the general torpor of nature, and all their faculties are for two or three months suspended; but if they abstain at one time, they are equally voracious at another, and, like snakes,

ants, and other animals, that are torpid in winter, the meal of one day suffices them for several months together. In general, however, they devour more largely in proportion to their size, and their growth is quick exactly as they are fed; such as are best supplied, soonest acquire their largest size, but they diminish also in their growth with the same facility if their food be taken away.

Such are the more obvious properties of these little animals, but the most wonderful still remain behind: their manner of propagation, or rather multiplication, has for some years been the astonishment of all the learned of Europe. They are produced in as great a variety of manner as every species of vegetable. Some polypi are propagated from eggs, as plants are from their seed: some are produced by buds issuing from their bodies, as plants are produced by inoculation; while all may be multiplied by cuttings, and this to a degree of minuteness that exceeds even philosophical perseverance.

With respect to such of this kind as are hatched from the egg, little curious can be added, as it is a method of propagation so common to all the tribes of insect nature; but with regard to such as are produced like buds from their parent stem, or like cuttings from an original root, their history requires a more detailed explanation. If a polypus be carefully observed in summer, when these animals are chiefly active, and more particularly prepared for propagation, it will be found to bourgeon forth from different parts of its body several tubercles or little knobs which grow larger and larger every day; after two or three days' inspection, what at first appeared but a small excrescence takes the figure of a small animal, entirely resembling its parent, furnished with feelers, a mouth, and all the apparatus for seizing and digesting its prey. This little creature every day becomes larger, like the parent to which it continues attached; it spreads its arms to seize upon whatever insect is proper for aliment, and devours it for its own particular benefit: thus it is possessed of two sources of nourishment, that which it receives from the parent by the tail, and that which it receives from its own industry by the mouth. The food which these animals receive often tinctures the whole body, and upon this occasion the parent is often seen communicating a part of its own fluids to that of its progeny that grows upon it; while, on the contrary, it never receives any tincture from any substance that is caught and swallowed by its young. If the parent swallows a red worm, which gives a tincture to all its fluids, the young one partakes of the parental colour; but if the latter should seize upon the same prey, the parent polypus is no way benefited by the capture, but all the advantage remains with the young one.

But we are not to suppose that the parent is capable of producing only one at a time; several

young ones are thus seen at once, of different sizes, growing from its body, some just budding forth, others acquiring their perfect form, and others come to sufficient maturity, and just ready to drop from the original stem to which they had been attached for several days. But what is more extraordinary still, those young ones themselves that continue attached to their parent, are seen to bourgeon, and propagate their own young ones also, each holding the same dependence upon its respective parent, and possessed of the same advantages that have been already described in the first connexion. Thus we see a surprising chain of existence continued, and numbers of animals naturally produced without any union of the sexes, or other previous disposition of nature.

This seems to be the most natural way by which these insects are multiplied; their production from the egg being not so common; and though some of this kind are found with a little bladder attached to their bodies, which is supposed to be filled with eggs, which afterwards come to maturity, yet the artificial method of propagating these animals is much more expeditious, and equally certain. It is indifferent whether one of them be cut into ten, or ten hundred parts, each becomes as perfect an animal as that which was originally divided; but it must be observed, that the smaller the part which is thus separated from the rest, the longer it will be in coming to maturity, or in assuming its perfect form. It would be endless to recount the many experiments that have been tried upon this philosophical prodigy: the animal has been twisted and turned into all manner of shapes; it has been turned inside out, it has been cut in every division, yet still it continued to move; its parts adapted themselves again to each other, and in a short time it became as voracious and industrious as before.

Besides these kinds mentioned by Mr. Trembley, there are various others which have been lately discovered by the vigilance of succeeding observers, and some of these so strongly resemble a flowering vegetable in their forms, that they have been mistaken by many naturalists for such. Mr. Hughes, the author of the natural history of Barbadoes, has described a species of this animal, but has mistaken its nature, and called it a sensitive flowering plant; he observed it to take refuge in the holes of rocks, and, when undisturbed, to spread forth a number of ramifications, each terminated by a flowery petal, which shrunk at the approach of the hand, and withdrew into the hole from whence before it had been seen to issue. This plant, however, was no other than an animal of the polypus kind, which is not only to be found in Barbadoes, but also on many parts of the coast of Cornwall, and along the shores of the continent.

SUPPLEMENTARY NOTE.

Leeuwenhoek discovered the Hydra in 1703, and the uncommon way its young are produced; and an anonymous correspondent of the Royal Society made the same discovery in England about the same time, but it excited no particular notice until Trembley made known its wonderful properties, about the year 1744. These were so contrary to all former experience, and so repugnant to every established notion of animal life, that the scientific world were amazed; and while the more cautious among Naturalists set themselves to verify what it was difficult to believe, there were many who looked upon the alleged facts as impossible fancies. The discoveries of Trembley were, however, speedily confirmed; and we are now so familiar with the outlines of the history of the fresh-water polype, and its marvellous reproductive powers, that we can scarcely appreciate the vividness of the sensation felt when it was all novel and strange; when the leading men of our learned societies were daily experimenting upon these poor worms, and transmitting them to one another from distant countries, by careful posts, and as most precious gifts, and when even ambassadors interested themselves in sending early intelligence of the engrossing theme to their respective courts.

The hydra are found in fresh, and, perhaps, also in salt waters, but the former species only have been examined with care, and are the objects of the following remarks. They prefer slowly running or almost still water, and fasten to the leaves and stalks of submerged plants by their base, which seems to act as a sucker. The body is exceedingly contractile, and hence liable to many changes of form. When contracted, it is like a tubercle, a minute top, or button, and when extended it becomes a narrow cylinder, being ten or twelve times longer at one time than at another, the tentacula suffering changes in their length and diameter equal to those of the body. "It can lengthen out or shorten its arms, without extending or contracting its body; and can do the same by the body, without altering the length of its arms; both, however, are usually moved together, at the same time, and in the same direction." The whole creature is apparently homogeneous, composed of minute pellucid grains cohering by means of a transparent jelly, for, even with a high magnifier, no defined organization of vessels and fibres can be detected. On the point opposite the base, and in the centre of the tentacula, we observe an aperture or mouth which leads into a larger cavity, excavated as it were in the midst of the jelly, and from which a narrow canal is continued down to the sucker. When contracted, and also when fully extended, the body appears smooth and even, but "in its middle degree of extension," the sides seem to be minutely crenulated, an effect probably of a wrinkling of the surface, although from this appearance Baker has concluded that the hydra is annulose, or made up of a number of rings capable of being folded together or evolved, and hence in some measure its extraordinary ability of extending and contracting its parts. That this view of the hydra's structure is erroneous, Trembley has proved; and the explanation it afforded of the animal's contractility was obviously unsatisfactory, for it was never pretended that such an anatomy could be detected in the tentacula, which, however, are equally or more contractile. These organs encircle the mouth, and radiate in a star-like fashion, but they seem to originate a little under the lip, for the mouth is often protruded with a kind of small snout; they are cylindrical, linear, or very slightly tapered, hollow, and roughened, at short and regular intervals, with whorls of tubercles which, under the microscope,

form a very beautiful and interesting object, and I have thought when viewing them, that every little tubercle might be a cup or sucker similar to those which garnish the arms of the cuttle-fish. Trembley has shown us that this is a deception, and that there is really no exactness in the comparison. The tentacula are amazingly extensible, from a line or less, to one, or, as in *Hydra fusca*, to more than eight inches; and "another extraordinary circumstance is, that a polype can extend an arm to any part of its whole length, without doing so throughout, and can swell or lessen its diameter, either at the root, at the extremity, in the middle, or where it pleases; which occasions a great variety of appearances, making it sometimes terminate with a sharp point, and at other times blunt, knobbed, and thickest at the end with the figure of a bobbin. We naturally inquire how this wonderful extension is made,—by what power a part without muscularity is drawn out until it exceeds by twenty or even by forty times the original length? The dissections of Trembley have proved beyond all doubt that the body is a hollow cylinder or bowel, and that the tentacula are tubular, and have a free communication with its cavity; and in this structure, combined with the loose granular composition of the animal, we find an answer to the question. Water flows, let us say by suction, into the stomach, through the oral aperture, whence it is forced, by the *cis a tergo*, or drawn by capillary attraction, into the canals of the tentacula, and its current outwards is sufficient to push before it the soft yielding material of which they are composed, until at last the resistance of the living parts suffices to arrest the tiny flood, or the tube has become too fine in its bore for the admission of water attenuated to its smallest possible stream,—how inconceivably slender may indeed be imagined, but there is no thread fine enough to equal it, seeing that the tentacula of *Hydra fusca* in tension can be compared to nothing grosser than the scarce visible filament of the gossamer's web.

The hydra, though usually found attached, can nevertheless move from place to place, which it does either by gliding with imperceptible slowness on the base, or by stretching out the body and tentacula to the utmost, fixing the latter, and then contracting the body towards the point of fixtue, loosening at the same time its hold with the base; and by reversing these actions it can retrograde. Its ordinary position seems to be pendant or nearly horizontal, hanging from some floating weed or leaf, or stretching from its sides. In a glass of water the creature will crawl up the sides of the vessel to the surface, and hang from it, sometimes with the base, and sometimes with the tentacula, downwards; and again it will lay itself along horizontally. Its locomotion is always very slow, and the disposition of the zoophyte is evidently sedentary; but the contractions and mutations of the body itself are sufficiently vivacious. While in seizing and mastering its prey it is surprisingly nimble; seizing a worm, to use the comparison of Baker, "with as much eagerness as a cat catcheth a mouse." It is dull, and does not expand freely, in the dark, but enjoys light, and hence undoubtedly the reason why we generally find the hydra near the surface and in shallow water.

The hydra are very voracious, feeding only on living animals, but when necessary they can sustain a fast of many weeks without other loss than what a paler colour may indicate. Small larvæ, worms, and entomostracous insects, seem to be the favourite food, and to entrap these, they expand the tentacula to the utmost, and spread them in every direction, moving them gently in the water to increase their chances, and when a worm, &c., touches any part of them, it is immediately seized, carried to the mouth by these flexible and contractile organs, and forced

into the stomach. "'Tis a fine entertainment," says Baker, "to behold the dexterity of a polype in the mastering its prey, and observe with what art it evades and overcomes the superior strength or agility thereof. Many times, by way of experiment, I have put a large worm to the very extremity of a single arm, which has instantly fastened on it with its little invisible clasps. Then it has afforded me inexpressible pleasure to see the polype poising and balancing the worm with no less seeming caution and judgment than a skilful angler shows when he perceives a heavy fish at the end of a single hair-line, and fears it should break away. Contracting the arm that holds it, by very slow degrees, he brings it within the reach of his other arms, which eagerly clasping round it, and the danger of losing it being over, all the former caution and gentleness is laid aside, and it is pulled to the polype's mouth with a surprising violence." Sometimes it happens that two polypes will seize upon the same worm, when a struggle for the prey ensues, in which the strongest gains of course the victory; or each polype begins quietly to swallow his portion, and continues to gulp down his half until the mouths of the pair near, and come at last into actual contact. The rest which now ensues appears to prove that they are sensible of their outward position, from which they are frequently liberated by the opportune break of the worm, when each obtains his share; but should the prey prove too tough, woe to the unready! The more resolute dilates the mouth to the requisite extent, and deliberately swallows his opponent, sometimes partially, so as, however, to compel the discharge of the bait, while at other times, the entire polype is engulfed! But a polype is no fitting food for a polype, and his capacity of endurance saves him from this living tomb, for after a time, when the worm is sucked out of him, the sufferer is disgorged with no other loss than his dinner. This fact is the more remarkable when it is contrasted with the fate which awaits the worms on which they feed. No sooner are these laid hold upon than they evince every symptom of painful suffering, but their violent contortions are momentary, and a certain death suddenly follows their capture. How this effect is produced is mere matter of conjecture. Worms, in ordinary circumstances are most tenacious of life even under severe wounds, and hence one is inclined to suppose that there must be something eminently poisonous in the hydra's grasp, as it is impossible to believe, with Baker, that this soft and toothless creature can bite and inject a venom into the wound it gives. "I have sometimes," says Baker, "forced a worm from a polype the instant it has been bitten, (at the expense of breaking off the polype's arms,) and have always observed it to die very soon after, without one single instance of recovery." To the Entomostraca, however, its touch is not equally fatal, for I have repeatedly seen cyprides and daphniæ entangled in the tentacula, and arrested for some considerable time, escape even from the very lips of the mouth, and swim about afterwards unharmed; perhaps their shell may protect them from the poisonous excretion. The grosser parts of the food, after some hours' digestion, are again ejected by the mouth; but, as already mentioned, the stomach is furnished with what, in one sense, may be called an intestine, to which, according to Trembley and Baker, there is an outlet in the centre of the base, and the latter asserts that he has, "several times, seen the dung of the polype, in little round pellets, discharged at this outlet or anus."—*Dr. Johnston's British Zoophytes.*

CHAP. V.

OF THE LYTROPHYTES AND SPONGES.

It is very probable that the animals we see and are acquainted with, bear no manner of proportion to those that are concealed from us. Although every leaf and vegetable swarms with animals upon land, yet at sea they are still more abundant; for the greatest part of what would seem vegetables growing there, are in fact nothing but the artificial formation of insects, palaces which they have built for their own habitation.

If we examine the bottom of the sea along some shores, and particularly at the mouths of several rivers, we shall find it has the appearance of a forest of trees under water, millions of plants growing in various directions, with their branches entangled in each other, and sometimes standing so thick as to obstruct navigation. The shores of the Persian gulf, the whole extent of the Red sea, and the western coasts of America, are so choked up in many places with these coralline substances, that though ships force a passage through them, boats and swimmers find it impossible to make their way. These aquatic groves are formed of different substances, and assume various appearances. The coral plants, as they are called, sometimes shoot out like trees without leaves in winter; they often spread out a broad surface like a fan, and not uncommonly a large bundling head like a faggot; sometimes they are found to resemble a plant with leaves and flowers; and often the antlers of a stag, with great exactness and regularity. In other parts of the sea are seen sponges of various magnitude, and extraordinary appearances, assuming a variety of fantastic forms, like large mushrooms, mitres, fonts, and flower-pots. To an attentive spectator, these various productions seem entirely of the vegetable kind; they seem to have their leaves and their flowers, and have been experimentally known to shoot out branches in the compass of a year. Philosophers, therefore, till of late, thought themselves pretty secure in ascribing these productions to the vegetable kingdom; and Count Marsigli, who has written very laboriously and learnedly upon the subject of corals and sponges, has not hesitated to declare his opinion, that they were plants of the aquatic kind, furnished with flowers and seeds, and endowed with a vegetation entirely resembling that which is found upon land. This opinion, however, some time after, began to be shaken by Rumphius and Jussieu, and at last by the ingenious Mr. Ellis, who, by a more sagacious and diligent inquiry into nature, put it past doubt, that corals and sponges were entirely the works of animals, and that, like the honeycomb which was formed by the bee, the coral was the work of an infinite number of reptiles of the polypus

kind, whose united labours were thus capable of filling whole tracts of the ocean with those embarrassing tokens of their industry.

If, in our researches after the nature of these plants, we should be induced to break off a branch of the coralline substance, and observe it carefully, we shall perceive its whole surface, which is very rugged and irregular, covered with a mucous fluid, and almost in every part studded with little jelly-like drops, which, when closely examined, will be found to be no other than reptiles of the polypus kind. These have their motions, their arms, their appetites, exactly resembling those described in the last chapter; but they soon expire when taken out of the sea, and our curiosity is at once stopped in its career, by the animals ceasing to give any mark of their industry: recourse, therefore, has been had to other expedients in order to determine the nature of the inhabitant, as well as the habitation.

If a coralline plant be strictly observed, while still growing in the sea, and the animals upon its surface be not disturbed, either by the agitation of the waters, or the touch of the observer, the little polypi will then be seen in infinite numbers, each issuing from its cell, and in some kinds the head covered with a little shell, resembling an umbrella, the arms spread abroad, in order to seize its prey, while the hinder part still remains attached to its habitation, from whence it never wholly removes. By this time it is perceived, that the number of inhabitants is infinitely greater than was at first suspected; and that they are all assiduously employed in the same pursuits, and that they issue from their respective cells, and retire into them at pleasure. Still, however, there are no proofs that those large branches which they inhabit, are entirely the construction of such feeble and minute animals. But chemistry will be found to lend a clue to extricate us from our doubts in this particular. Like the shells which are formed by snails, mussels, and oysters, these coralline substances effervesce with acids; and may therefore well be supposed to partake of the same animal nature. But Mr. Ellis went still farther, and examined their operations, just as they were beginning. Observing an oyster-bed which had been for some time neglected, he there perceived the first rudiments of a coralline plantation, and tufts of various kinds shooting from different parts of this favourable soil. It was upon these he tried his principal experiment. He took out the oysters which were thus furnished with corallines, and placed them in a large wooden vessel, covering them with sea-water. In about an hour, he perceived the animals, which before had been contracted by handling, and had shown no signs of life, expanding themselves in every direction, and appearing employed in their own natural manner. Perceiving them, therefore, in this state, his next aim was to preserve them thus expanded, so as to be permanent objects of

curiosity. For this purpose, he poured, by slow degrees, an equal quantity of boiling water into the vessel of sea-water in which they were immersed. He then separated each polypus with pincers from its shell, and plunged each separately into small crystal vases, filled with spirit of wine mixed with water. By this means the animal was preserved entire, without having time to contract itself, and he thus perceived a variety of kinds, almost equal to that variety of productions which these little animals are seen to form. He has been thus able to perceive and describe fifty different kinds, each of which is seen to possess its own peculiar mode of construction, and to form a coralline that none of the rest can imitate. It is true indeed, that on every coralline substance there are a number of polypi found, no way resembling those which are the erectors of the building: these may be called a vagabond race of reptiles, that are only intruders upon the labours of others, and that take possession of habitations, which they have neither art nor power to build for themselves. But, in general, the same difference that subsists between the honeycomb of the bee, and the paper-like cells of the wasp, subsists between the different habitations of the coral-making polypi.

With regard to the various forms of these substances, they have obtained different names from the nature of the animal that produced them, or the likeness they bear to some well-known object, such as coralines, fungi-madrepores, sponges, astroites, and keratophytes. Though these differ extremely in their outward appearances, yet they are all formed in the same manner by reptiles of various kinds and nature. When examined chemically, they all discover the marks of animal formation; the corals, as was said, dissolve in acids, the sponges burn with an odour strongly resembling that of burnt horn. We are left somewhat at a loss with regard to the precise manner in which this multitude of cells, which at last assume the appearance of a plant or flower, are formed.

If we may be led in this subject by analogy, it is most probable, that the substance of coral is produced in the same manner that the shell of the snail grows round it; these little reptiles are each possessed of a slimy matter, which covers its body, and this hardening, as in the snail, becomes a habitation exactly fitted to the body of the animal that is to reside in it; several of these habitations being joined together, form at length a considerable mass; and as most animals are productive in proportion to their minuteness, so these multiplying in a surprising degree, at length form those extensive forests that cover the bottom of the deep.

Thus all nature seems replete with life; almost every plant on land has its surface covered with millions of these minute creatures, of whose existence we are certain, but of whose uses we are entirely ignorant; while numbers of what

seem plants at sea, are not only the receptacles of insects, but also entirely of insect formation. This might have led some late philosophers into an opinion, that all nature was animated; that every, even the most inert, mass of matter was endued with life and sensation, but wanted organs to make those sensations perceptible to the observer: those opinions, taken up at random, are difficultly maintained, and as difficultly refuted; like combatants that meet in the dark, each party may deal a thousand blows without ever reaching the adversary. Those, perhaps, are wiser who view nature as she offers; who, without searching too deeply into the recesses into which she ultimately hides, are contented to take her as she presents herself; and storing their minds with effects rather than with causes, instead of the embarrassment of systems, about which few agree, are contented with the history of appearances, concerning which all mankind have but one opinion.

SUPPLEMENTARY NOTE.

The genus *Madrepore* consists of many species, of varied form, and many of them most elegant in their structure. The animal resembles a medusa; the coral has lamellate, star-shaped cavities. It is principally in hot climates, betwixt the tropics, that they are in greatest abundance. Few of them have been observed in any of the European seas, except the Mediterranean. Many species are found in a fossil state.

In the *Truncated Madrepore*, it is curious to remark the poroliferous mode in which the new joints arise from the surfaces of the already formed stars.

The *Cup Madrepore* is clavate, and turbinated with a tapering base; the star is obconic, with a double prominent jagged centre. This coral is dragged up in great abundance by the coral-fishers on the southern coast of France and Italy; it is always found single, without branches, and generally adhering to a piece of red coral. It is of a white colour, and very hard. The lamellæ, or gills, are about forty in number, and as many intermediate small ones; the latter extend to the margin, but do not reach to the bottom of the star, like the larger ones. The common, or middle size of this coral, is about two inches long, and three quarters of an inch in diameter, in the broadest part.

The *Mushroom Madrepore* is orbicular and convex, with simple longitudinal gills; beneath, concave and papilous. This coral is met with in great abundance in the Red Sea, and the East Indian ocean; it is frequently found of five or six inches diameter, and often of a milk-white colour.

The genus *Coraline* consists of animals greatly resembling plants, and has been thought by some writers to belong entirely to the vegetable kingdom, and to differ but little from fucuses and confervas: but as Linnæus observes, that all calcareous substances are truly of animal production, therefore these coralines, consisting of that substance, do belong to the animal kingdom.

What or where the link is that unites the animal and vegetable kingdoms of nature, no one has yet been able to point out: some of these coralines appear to come the nearest to it of any other animal production; but then the calcareous covering, though ever so thin, shows us that they cannot be vegetables. The white mealy substance on the surface of some of the lichens would induce one to think

them covered with a calcareous matter; but chemistry shows us, it is no more of a calcareous nature than the mealy whiteness of various auriculae. The minuteness of the pores of coralines, though as small as those of some plants, is no proof of their being vegetables; because there may be suckers that come through these pores which our glasses cannot discover; or perhaps they may be, like the pores of sponges, contrived in such a manner as to suck in and throw out the water. Let us observe the pores of those corals called millepores, and we shall find them equally as small as those of the coralines; and yet these are universally allowed to be of the animal kingdom. The characteristics of this genus are, that the animal grows in the form of a plant; and the stem is fixed, with calcareous subdivided branches, for the most part jointed.

The *Pencil coraline* varies in the thickness of its branches, as well as in its size. It is found from one inch to four inches long. In some the stem is very short; in others it is four times as long as the head. The joints are easily distinguished, where the branches divide; the stem is composed of tubular filaments covered with a calcareous crust. They adhere to shells by the base of these filaments.

The *Mop Coraline* has a single membranaceous wrinkled stem, on the top of which is a tuft of jointed dichotomous branches. This is the most singular of all this genus. It differs from the rest by the regular wrinkles of the stem, which is small at the base, and grows wider as it rises, till it sends forth its branches at the top. From the base it sends forth branched tubes, like the *Sertularias*, by which it adheres: these tubes do not lessen as they extend, but have an equal diameter their whole length.

The *Sertularia*, or *Sea-pen*, is a many-headed animal, growing in the shape of a plant, and fixed by its base. Its tubulous horny stem is full of cup-shaped denticles, through which proceed little heads, in the form of polypes, from the gelatinous medullary part which is continued through the inside. Nature has been very favourable to the animals of this genus, in providing little cup-like denticles to secure their many tender heads safe, when they are drawn in upon any alarm of danger; whereas the heads of the tubular coralines have no such protection, for which reason they are not so often found in the turbulent parts of the ocean, as in sheltered recesses.

The *Pen-shaped Sertularia*, or *Sea-pen* has a single pennated stem; the pinnae, or side small branches, are jointed and curved; the denticles are ranged on one side, each supported by a little horn-like tube; they have a crenated margin, with a little spine on each side, opposite to each other; the ovaries are not known. This coraline is as remarkable from the elegance of its form, as its likeness to

the feather of a pen. It is of a yellowish brown colour, about five or six inches high.

The genus *Sponge* is exceedingly complicated, and still remains in much doubt with various individuals. Colonel Montagu is of opinion that they are animal substances, although no polypi, or vermes of any kind, have as yet been discovered in their cells or pores; and that they possess vitality without perceptible action or motion. By some they have been supposed to be the fabric of certain worms allied to terebellae, which are often found straying about in cavities; an idea not very probable, and now sufficiently exploded. Others have imagined them to be mere vegetables; but that they are really possessed of a living principle seems evident from the circumstance of their alternately contracting and dilating their pores, and shrinking in some degree from the touch when examined in their native waters. In short, sponges consist of an infinitely ramified mass of capillary tubes, possessed of a certain degree of contractile power, and capable from their structure of absorbing nutriment from the surrounding fluid in which they are by nature immersed. They therefore form an animal tribe different from all others, and may be considered as the most torpid of all zoophytes.

The *Funnel-sponge* is funnel-shaped, and flexible, with the surface more or less roughened and irregular. It is found both in the Mediterranean and Indian seas, adhering like others of its genus to rocks. In size it varies from a few inches in diameter to that of a foot or more. Its colour is pale brown, and its substance less strong or tenacious than that of the common or officinal species.

The *Vorticellae*, or *Wheel-animals*, are the most remarkable of all animalcules, not only in their structure, but also in their habits and production. In general form they bear a great affinity to the polypes; having a contractile, naked body, furnished with rotatory organs round the mouth; indeed many microscopical writers have denominated them *cluster polypes*. They are almost invisibly minute, and generally found in clear stagnant waters, during the summer months, attached to the stalks of the lesser water-plants, where they feed on animalcules still smaller than themselves. Many of the species are found in groups, sometimes formed by the mere approximation of several individuals, and at other times by the ramified or aggregate manner in which they grow. Their various motions, like those of the polypes, are generally exerted only for the purpose of obtaining prey. The rotatory motion of their tentacula cause an eddy in the water, around each individual, sufficient to attract into its vortex such animalcules as happen to swim near; these the little creature seizes, by suddenly contracting its tentacula, and enclosing them.







1. The first step in the process is to identify the problem. This involves a thorough inspection of the area affected by the issue. Once the problem has been identified, the next step is to determine the cause of the problem. This can be done by looking for signs of damage or by consulting with a professional. Once the cause has been identified, the next step is to develop a plan to address the problem. This plan should take into account the severity of the problem and the resources available. Once a plan has been developed, the next step is to implement the plan. This involves taking the necessary steps to address the problem, such as repairing damaged areas or replacing faulty equipment. Finally, the last step in the process is to evaluate the results of the intervention. This involves monitoring the area affected by the problem to ensure that the problem has been resolved and that no further damage has occurred.









LIST OF PLATES, AND EXPLANATION OF THEIR CONTENTS.

PLATE I.

- | | | |
|--------------------------|--|---------------------------|
| 1. Red-winged Bee-eater. | | 2. Blue-headed Bee-eater. |
|--------------------------|--|---------------------------|

PLATE II.

- | | | |
|--------------------|--|--------------------|
| 1. Addax Antelope. | | 2. Sable Antelope. |
|--------------------|--|--------------------|

PLATE III.

- | | | |
|-------------------|--|----------------------|
| 1. Chacma Baboon. | | 2. Dog-faced Baboon. |
|-------------------|--|----------------------|

PLATE IV.

African Elephant (young)

PLATE V.

- | | | |
|----------------|--|------------------------|
| 1. Suffolk Ox. | | 2. Herefordshire Bull. |
|----------------|--|------------------------|

PLATE VI.

- | | | |
|-----------------|--|----------------------|
| 1. Babyroussa. | | 3. White-lipped Hog. |
| 2. Chinese Hog. | | 4. Collared Hog. |

PLATE VII.

- | | | |
|----------------------|--|------------------------|
| 1. Ass-eared Jerboa. | | 3. Flat-tailed Jerboa. |
| 2. Broad-tailed do. | | |

PLATE VIII.

- | | | |
|-------------------|--|-----------------|
| 1. Leopard. | | 4. Ocelot. |
| 2. Neuwied Cat. | | 5. Sumatra Cat. |
| 3. Clouded Tiger. | | |

PLATE IX.

- | | | |
|-----------|--|----------------------|
| 1. Tiger. | | 3. African Lion. |
| 2. Puma. | | 4. Lioness and Cubs. |

PLATE X.

- | | | |
|----------------------|--|-----------------|
| 1. Long-tailed Deer. | | 3. Fallow Deer. |
| 2. Virginian do. | | |

PLATE XI.

Jaguar (female).

LIST OF PLATES.

PLATE XII.

Cape Jackall.

| 2. American Grey Wolf.

PLATE XIII.

1. Fine Bat.
2. Eared do.

| 3. 4. Slender Bat.
5. 6. Rufous do.

PLATE XIV.

| 4. King Charles' Cocker.
5. Comforter.

PLATE XV.

| 4. Red-footed Bat.
5. Common Vampire Bat.

PLATE XVI.

Howler.

| 2. Golden-tailed Howler.

PLATE XVII.

an squirrel.
et

| 3. Grey Squirrel.

PLATE XVIII.

| 2. Black-cheeked Oriole.

PLATE XIX.

Large-footed Partridge (Female).

| 2. Large-footed Partridge (Male).

PLATE XX.

New Zealand Caracara.

PLATE XXI.

1. Purple-crowned Pigeon.

| 2. Red-collared Pigeon.

PLATE XXII.

Common Hoopoe.

PLATE XXIII.

1. Toco Toucan.
2. Tocard Toucan.

| 3. Blue-billed Toucan.

PLATE XXIV.

1. Selby's Gnat-catcher.
2. Yellow-tailed do. (Male).

| 3. Yellow-tailed Gnat-catcher (Female).

PLATE XXV.

1. White-eared Humming Bird.
2. Crested do. (Female).
3. Sapphirine do. (Female).

| 4. Mango Humming Bird (Young Male).
5. Violet-eared do. (Female).
6. Tufted-necked do. (Male).

PLATE XXVI.

1. Azure-crowned Humming Bird (Young).
2. Azure-crowned do. (Male).
3. White-striped do. (Female)

| 4. Temminck's Humming Bird.
5. Blue-fronted do.

PLATE XXVII.

- | | |
|---------------------------|-------------------|
| 1. Crocodile of the Nile. | 3. Dragon Lizard. |
| 2. Ornamented Tupinambis. | 4. Common Guana. |

PLATE XXVIII.

- | | |
|-------------------------|----------------------------------|
| 1. Green Thrush-Shrike. | 3. White-throated Thrush-Shrike. |
| 2. Bacbakiri do. | |

PLATE XXIX.

- | | |
|-------------------|-----------------------|
| 1. Bewick's Swan. | 2. Black-necked Swan. |
|-------------------|-----------------------|

PLATE XXX.

- | | |
|---------------------|----------------------------|
| 1. Common Porpoise. | 3. White Whale. |
| 2. Ca'ing Whale. | 4. Narwhal or Sea Unicorn. |

PLATE XXXI.

- | | |
|----------------------------------|------------------------------------|
| 1. Horsfield's Eurylaima (Male). | 2. Horsfield's Eurylaima (Female). |
|----------------------------------|------------------------------------|

PLATE XXXII.

- | | |
|-------------------------|--------------------------|
| 1. Scorpens Antennata. | 3. Pimelepterus Bosquii. |
| 2. Chæstodon Rostratus. | 4. Chæstodon Cornutus. |

PLATE XXXIII.

- | | |
|--------------------------------------|-----------------------|
| 1. Scorpena Surinamensis. | 4. Raia Marginata. |
| 2. Scorpena Insidiator. | 5. Chimæra Monstrosa. |
| 3. Gymnetrus Hawkenii. | |

PLATE XXXIV.

- | | |
|-------------------------------|-----------------------------------|
| 1. American Crossbill (Male). | 2. White-winged Crossbill (Male). |
|-------------------------------|-----------------------------------|

PLATE XXXV.

- | | |
|--------------------------|------------------------|
| 1. Fire-footed Squirrel. | 2. Hottentot Squirrel. |
|--------------------------|------------------------|

PLATE XXXVI.

- | | |
|-------------------------------------|---------------------------------|
| 1. White-winged Crossbill (Female). | 2. American Crossbill (Female). |
|-------------------------------------|---------------------------------|

PLATE XXXVII.

Ostrich (Female).

PLATE XXXVIII.

White-headed Eagle.

PLATE XXXIX.

- | | |
|------------------------------------|-----------------------------|
| 1. 2. Royal Butterfly. | 7. Silver Streak Butterfly. |
| 3. 4. Azure-blue Butterfly (Male). | 8. 9. Nicippe do. |
| 5. Do. do. (Female). | 10. Merry do. |
| 6. Mazarine-blue do. | |

PLATE XL.

- | | |
|----------------------------|--------------------------------|
| 1. Painted Lady Butterfly. | 5. Oriental Emperor Butterfly. |
| 2. 3. Amphinome do. | 6. Elm do. |
| 4. Merry do. | |

PLATE XLI.

Long-eared Owl.

LIST OF PLATES.

PLATE XLII.

1. Gigantic Beetle (Male).
2. Hieroglyphic Beetle.
3. Kangaroo do.
4. Macleay's do.
5. Shining do.

6. Prodigal Beetle.
7. Gigantic do. (Female).
8. Golden do.
9. Elephant do.
10. Peruvian do.

PLATE XLIII.

1. Vicugna of Peru.

2. 3. Argali or Big Horn.

PLATE XLIV.

1. Tait's Cone.
2. Diviner's do.
3. Fumigated do.
4. Plated do.
5. Punctured do.
6. Geographic do.

7. Franciscan Cone.
8. Striated do.
9. Matchless do.
10. 12. Stone-cutter do.
11. Flea-spot do.
13. Fumigated do.

PLATE XLV.

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 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422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840. 841. 842. 843. 844. 845. 846. 847. 848. 849. 850. 851. 852. 853. 854. 855. 856. 857. 858. 859. 860. 861. 862. 863. 864. 865. 866. 867. 868. 869. 870. 871. 872. 873. 874. 875. 876. 877. 878. 879. 880. 881. 882. 883. 884. 885. 886. 887. 888. 889. 890. 891. 892. 893. 894. 895. 896. 897. 898. 899. 900. 901. 902. 903. 904. 905. 906. 907. 908. 909. 910. 911. 912. 913. 914. 915. 916. 917. 918. 919. 920. 921. 922. 923. 924. 925. 926. 927. 928. 929. 930. 931. 932. 933. 934. 935. 936. 937. 938. 939. 940. 941. 942. 943. 944. 945. 946. 947. 948. 949. 950. 951. 952. 953. 954. 955. 956. 957. 958. 959. 960. 961. 962. 963. 964. 965. 966. 967. 968. 969. 970. 971. 972. 973. 974. 975. 976. 977. 978. 979. 980. 981. 982. 983. 984. 985. 986. 987. 988. 989. 990. 991. 992. 993. 994. 995. 996. 997. 998. 999. 1000. 1001. 1002. 1003. 1004. 1005. 1006. 1007. 1008. 1009. 1010. 1011. 1012. 1013. 1014. 1015. 1016. 1017. 1018. 1019. 1020. 1021. 1022. 1023. 1024. 1025. 1026. 1027. 1028. 1029. 1030. 1031. 1032. 1033. 1034. 1035. 1036. 1037. 1038. 1039. 1040. 1041. 1042. 1043. 1044. 1045. 1046. 1047. 1048. 1049. 1050. 1051. 1052. 1053. 1054. 1055. 1056. 1057. 1058. 1059. 1060. 1061. 1062. 1063. 1064. 1065. 1066. 1067. 1068. 1069. 1070. 1071. 1072. 1073. 1074. 1075. 1076. 1077. 1078. 1079. 1080. 1081. 1082. 1083. 1084. 1085. 1086. 1087. 1088. 1089. 1090. 1091. 1092. 1093. 1094. 1095. 1096. 1097. 1098. 1099. 1100. 1101. 1102. 1103. 1104. 1105. 1106. 1107. 1108. 1109. 1110. 1111. 1112. 1113. 1114. 1115. 1116. 1117. 1118. 1119. 1120. 1121. 1122. 1123. 1124. 1125. 1126. 1127. 1128. 1129. 1130. 1131. 1132. 1133. 1134. 1135. 1136. 1137. 1138. 1139. 1140. 1141. 1142. 1143. 1144. 1145. 1146. 1147. 1148. 1149. 1150. 1151. 1152. 1153. 1154. 1155. 1156. 1157. 1158. 1159. 1160. 1161. 1162. 1163. 1164. 1165. 1166. 1167. 1168. 1169. 1170. 1171. 1172. 1173. 1174. 1175. 1176. 1177. 1178. 1179. 1180. 1181. 1182. 1183. 1184. 1185. 1186. 1187. 1188. 1189. 1190. 1191. 1192. 1193. 1194. 1195. 1196. 1197. 1198. 1199. 1200. 1201. 1202. 1203. 1204. 1205. 1206. 1207. 1208. 1209. 1210. 1211. 1212. 1213. 1214. 1215. 1216. 1217. 1218. 1219. 1220. 1221. 1222. 1223. 1224. 1225. 1226. 1227. 1228. 1229. 1230. 1231. 1232. 1233. 1234. 1235. 1236. 1237. 1238. 1239. 1240. 1241. 1242. 1243. 1244. 1245. 1246. 1247. 1248. 1249. 1250. 1251. 1252. 1253. 1254. 1255. 1256. 1257. 1258. 1259. 1260. 1261. 1262. 1263. 1264. 1265. 1266. 1267. 1268. 1269. 1270. 1271. 1272. 1273. 1274. 1275. 1276. 1277. 1278. 1279. 1280. 1281. 1282. 1283. 1284. 1285. 1286. 1287. 1288. 1289. 1290. 1291. 1292. 1293. 1294. 1295. 1296. 1297. 1298. 1299. 1300. 1301. 1302. 1303. 1304. 1305. 1306. 1307. 1308. 1309. 1310. 1311. 1312. 1313. 1314. 1315. 1316. 1317. 1318. 1319. 1320. 1321. 1322. 1323. 1324. 1325. 1326. 1327. 1328. 1329. 1330. 1331. 1332. 1333. 1334. 1335. 1336. 1337. 1338. 1339. 1340. 1341. 1342. 1343. 1344. 1345. 1346. 1347. 1348. 1349. 1350. 1351. 1352. 1353. 1354. 1355. 1356. 1357. 1358. 1359. 1360. 1361. 1362. 1363. 1364. 1365. 1366. 1367. 1368. 1369. 1370. 1371. 1372. 1373. 1374. 1375. 1376. 1377. 1378. 1379. 1380. 1381. 1382. 1383. 1384. 1385. 1386. 1387. 1388. 1389. 1390. 1391. 1392. 1393. 1394. 1395. 1396. 1397. 1398. 1399. 1400. 1401. 1402. 1403. 1404. 1405. 1406. 1407. 1408. 1409. 1410. 1411. 1412. 1413. 1414. 1415. 1416. 1417. 1418. 1419. 1420. 1421. 1422. 1423. 1424. 1425. 1426. 1427. 1428. 1429. 1430. 1431. 1432. 1433. 1434. 1435. 1436. 1437. 1438. 1439. 1440. 1441. 1442. 1443. 1444. 1445. 1446. 1447. 1448. 1449. 1450. 1451. 1452. 1453. 1454. 1455. 1456. 1457. 1458. 1459. 1460. 1461. 1462. 1463. 1464. 1465. 1466. 1467. 1468. 1469. 1470. 1471. 1472. 1473. 1474. 1475. 1476. 1477. 1478. 1479. 1480. 1481. 1482. 1483. 1484. 1485. 1486. 1487. 1488. 1489. 1490. 1491. 1492. 1493. 1494. 1495. 1496. 1497. 1498. 1499. 1500. 1501. 1502. 1503. 1504. 1505. 1506. 1507. 1508. 1509. 1510. 1511. 1512. 1513. 1514. 1515. 1516. 1517. 1518. 1519. 1520. 1521. 1522. 1523. 1524. 1525. 1526. 1527. 1528. 1529. 1530. 1531. 1532. 1533. 1534. 1535. 1536. 1537. 1538. 1539. 1540. 1541. 1542. 1543. 1544. 1545. 1546. 1547. 1548. 1549. 1550. 1551. 1552. 1553. 1554. 1555. 1556. 1557. 1558. 1559. 1560. 1561. 1562. 1563. 1564. 1565. 1566. 1567. 1568. 1569. 1570. 1571. 1572. 1573. 1574. 1575. 1576. 1577. 1578. 1579. 1580. 1581. 1582. 1583. 1584. 1585. 1586. 1587. 1588. 1589. 1590. 1591. 1592. 1593. 1594. 1595. 1596. 1597. 1598. 1599. 1600. 1601. 1602. 1603. 1604. 1605. 1606. 1607. 1608. 1609. 1610. 1611. 1612. 1613. 1614. 1615. 1616. 1617. 1618. 1619. 1620. 1621. 1622. 1623. 1624. 1625. 1626. 1627. 1628. 1629. 1630. 1631. 1632. 1633. 1634. 1635. 1636. 1637. 1638. 1639. 1640. 1641. 1642. 1643. 1644. 1645. 1646. 1647. 1648. 1649. 1650. 1651. 1652. 1653. 1654. 1655. 1656. 1657. 1658. 1659. 1660. 1661. 1662. 1663. 1664. 1665. 1666. 1667. 1668. 1669. 1670. 1671. 1672. 1673. 1674. 1675. 1676. 1677. 1678. 1679. 1680. 1681. 1682. 1683. 1684. 1685. 1686. 1687. 1688. 1689. 1690. 1691. 1692. 1693. 1694. 1695. 1696. 1697. 1698. 1699. 1700. 1701. 1702. 1703. 1704. 1705. 1706. 1707. 1708. 1709. 1710. 1711. 1712. 1713. 1714. 1715. 1716. 1717. 1718. 1719. 1720. 1721. 1722. 1723. 1724. 1725. 1726. 1727. 1728. 1729. 1730. 1731. 1732. 1733. 1734. 1735. 1736. 1737. 1738. 1739. 1740. 1741. 1742. 1743. 1744. 1745. 1746. 1747. 1748. 1749. 1750. 1751. 1752. 1753. 1754. 1755. 1756. 1757. 1758. 1759. 1760. 1761. 1762. 1763. 1764. 1765. 1766. 1767. 1768. 1769. 1770. 1771. 1772. 1773. 1774. 1775. 1776. 1777. 1778. 1779. 1780. 1781. 1782. 1783. 1784. 1785. 1786. 1787. 1788. 1789. 1790. 1791. 1792. 1793. 1794. 1795. 1796. 1797. 1798. 1799. 1800. 1801. 1802. 1803. 1804. 1805. 1806. 1807. 1808. 1809. 1810. 1811. 1812. 1813. 1814. 1815. 1816. 1817. 1818. 1819. 1820. 1821. 1822. 1823. 1824. 1825. 1826. 1827. 1828. 1829. 1830. 1831. 1832. 1833. 1834. 1835. 1836. 1837. 1838. 1839. 1840. 1841. 1842. 1843. 1844. 1845. 1846. 1847. 1848. 1849. 1850. 1851. 1852. 1853. 1854. 1855. 1856. 1857. 1858. 1859. 1860. 1861. 1862. 1863. 1864. 1865. 1866. 1867. 1868. 1869. 1870. 1871. 1872. 1873. 1874. 1875. 1876. 1877. 1878. 1879. 1880. 1881. 1882. 1883. 1884. 1885. 1886. 1887. 1888. 1889. 1890. 1891. 1892. 1893. 1894. 1895. 1896. 1897. 1898. 1899. 1900. 1901. 1902. 1903. 1904. 1905. 1906. 1907. 1908. 1909. 1910. 1911. 1912. 1913. 1914. 1915. 1916. 1917. 1918. 1919. 1920. 1921. 1922. 1923. 1924. 1925. 1926. 1927. 1928. 1929. 1930. 1931. 1932. 1933. 1934. 1935. 1936. 1937. 1938. 1939. 1940. 1941. 1942. 1943. 1944. 1945. 1946. 1947. 1948. 1949. 1950. 1951. 1952. 1953. 1954. 1955. 1956. 1957. 1958. 1959. 1960. 1961. 1962. 1963. 1964. 1965. 1966. 1967. 1968. 1969. 1970. 1971. 1972. 1973. 1974. 1975. 1976. 1977. 1978. 1979. 1980. 1981. 1982. 1983. 1984. 1985. 1986. 1987. 1988. 1989. 1990. 1991. 1992. 1993. 1994. 1995. 1996. 1997. 1998. 1999. 2000. 2001. 2002. 2003. 2004. 2005. 2006. 2007. 2008. 2009. 2010. 2011. 2012. 2013. 2014. 2015. 2016. 2017. 2018. 2019. 2020. 2021. 2022. 2023. 2024. 2025. 2026. 2027. 2028. 2029. 2030. 2031. 2032. 2033. 2034. 2035. 2036. 2037. 2038. 2039. 2040. 2041. 2042. 2043. 2044. 2045. 2046. 2047. 2048. 2049. 2050. 2051. 2052. 2053. 2054. 2055. 2056. 2057. 2058. 2059. 2060. 2061. 2062. 2063. 2064. 2065. 2066. 2067. 2068. 2069. 2070. 2071. 2072. 2073. 2074. 2075. 2076. 2077. 2078. 2079. 2080. 2081. 2082. 2083. 2084. 2085. 2086. 2087. 2088. 2089. 2090. 2091. 2092. 2093. 2094. 2095. 2096. 2097. 2098. 2099. 2100. 2101. 2102. 2103. 2104. 2105. 2106. 2107. 21

PLATE LV.

1. Macklot's Breve.

| 2. Giant Breve.

PLATE LVI.

1. Yellow-throat Warbler.

| 3. Kentucky Warbler.

2. Maryland Yellow-throat do.

PLATE LVII.

1. Black Bear of America.

| 3. Polar Bear.

2. Brown Bear of Europe.

PLATE LVIII.

Dalggtai.

PLATE LIX.

Datiw (Female).

PLATE LX.

1. Acute Agate Shell.

7. Virgin Agate.

2. Variegated Agate.

8. 9. White-lined do.

3. Turbo Scalaris or Wentle Trap.

10. Patched Cassis.

4. Zebra Agate.

11. Diana's Ear Strombus.

5. Flary do.

12. Knotty Pterocera.

6. Chestnut do.

13. Roseate Harpa.

PLATE LXI.

1. Slender Parrakeet.

| 2. Iris Parrakeet.

PLATE LXII.

1. Zibet.

| 3. Malacca Genet.

2. Fossane.

PLATE LXIII.

1. Skye Terrier.

| 2. Blood Hound.

PLATE LXIV.

1. Davancel's Trogon.

| 2. Narina Trogon.

PLATE LXV.

Tonga Ronsette.

PLATE LXVI.

1. Araponga Summer Bird (Female).

| 2. Red-breasted Fruit Crow.

PLATE LXVII.

1. Tiriba Parrakeet.

| 2. Coquette Parrakeet (Female).

PLATE LXVIII.

1. Little Galago.

| 3. Senegal Galago.

2. Podje Tarsier.

PLATE LXIX.

1. Long-tailed-Quail.

| 2. Montezuma's Quail.

PLATE LXX.

1. Swarthy Tendrac.
2. Long-eared Hedgehog.

3. Armed Tenrec.

PLATE LXXI.

1. Common Albatross.
2. Sooty do.

3. Black-eyed Albatross.

PLATE LXXII.

1. Weasel.
2. Ermine (Winter).

3. Pine Martin.
4. Vison.

VIGNETTE, Vol. I. Collared Cat.

VIGNETTE, Vol. II. White-striped Humming Bird (Male).

INDEX.

The Roman character refers to the volume, the Arabic number to the page. The letters *Int.* refer to the Introductory View of the Animal Kingdom. The letter *n* affixed to any number directs to the note contained in the page to which reference is made.

- Abdominal-fish in Mr. Gouan's arrangement of spinous fishes characterized by the position of the ventral fins, ii. 284; the prickly finned, 286; the soft finned, 288—292 and *n*.
- Abel, Dr. Clarke, his account of two oran-outangs, i. 491, 492 *n*.
- Abstinence, benefits of occasional voluntary, i. 212; Queen Elizabeth's commands concerning, *ib.*; how defeated, *ib.*; of the primitive Christians, *ib.*
- Acalephæ, *Int.* i.
- Acanthopteri, or prickly-finned fish, ii. 284; the varieties specified and described, 284—286 and *n*.
- Acephala, *Int.* xlix.
- Achilles the second, a Roman tribune, his strength, i. 209.
- Acidulous waters, their properties, i. 118 *n*.
- Acorn, shell-fish, account of the, ii. 342; the bell, where found, *ib.* *n*.
- Acotyledones, *Int.* xlviii.
- Actinæ, or sea anemones, ii. 491 *n*.
- Ada, a kind of crocodile, its class and habits, ii. 369 *n*.
- Adder, Sea, the, described, ii. 282 *n*.
- Ægagrus, a species of ibex, described, i. 321 *n*.
- Ælian, his relations of the docility of the elephant, i. 499, and 507, 508 *n*.; of its propagation in the domestic state, 502 *n*.
- Æolipile, an instrument for producing wind, described, i. 159.
- Ætna, in Sicily, a volcano, i. 92.
- Africans. See Negroes.
- Age, the effects of, on the human body, i. 228; on the bones, *ib.*; on the cartilages, *ib.*; instances of great age in man, 229; of fishes, how determined, ii. 247.
- Agouti, distinguished from the rabbit in form, i. 437; its voracity, *ib.*; burrows in trees, 438; habitudes, *ib.*; flesh, *ib.*; how hunted, *ib.*; its cry, *ib.*; parturition, *ib.*
- Ai, a kind of sloth, i. 530.
- Aicurous, or great parrot, account of the, ii. 107.
- Air, i. 147; its elasticity and weight, 147, 148; expansion, 148; instruments to measure its weight, 148, 149; its composition and the history of its determination, 156, 157 *n*.; reflecting and refracting power of the, 157, 158 *n*.; that we breathe, how changed from the elementary body, 150, and 152; its corroding qualities, 151; necessary for vegetation and life, *ib.*; that extracted from plants, &c., fatal to life, 152; effects of, on man, *ib.*; the unwholesomeness of hot, 153; of cold, *ib.*; blessings of, 155; supports fire, *ib.*; conveys sounds, 155 and 158 *n*.; odours, 155; taste, 156; necessary to the life of fishes, ii. 245; how breathed by them, *ib.*
- Air bladder of fishes, account of the, ii. 246.
- Air pump, account of the, i. 149.
- Albanian dog, the ancient Molossus, i. 400 *n*.
- Albatross, described by Edwards, ii. 201; by Wicquefort, 202; its climate, *ib.*; said to sleep in the air, *ib.* and *n*.; voracity and activity, 202; affection for the penguin, *ib.*; nests of the, on the Falkland Isles, *ib.*; removed, why, *ib.*; account of, in the West Indies, 202 *n*.; the chocolate, *ib.*; the yellow-nosed, *ib.*; its size, *ib.* *n*.
- Albouras, volcano of, i. 94.
- Alcatraz, name given by Wicquefort to the Albatross, ii. 201.
- Alco, indigenous dog of South America, i. 399 *n*.
- Aldrovandus, the natural historian, his credulity, liberality, and misfortunes, ii. 220.
- Algazel, a kind of gazelle, i. 311.
- Algiers, earthquakes there 1755, i. 102 *n*.; 1825, *ib.*
- Alimentary canal, *Int.* x. xxvii.
- Alligator, the, distinguished from the crocodile, ii. 363 and 367 *n*. See Cayman.
- Alluvial deposits, i. 73 *n*.
- Alluvium, i. 83 *n*.
- Alps, description of a person ascending the, i. 107; rocks fall from them, 110; clefts in them, *ib.*; spaniel of the, described, its exertions for delivering travellers from the snow, 404 *n*.; one that saved twenty-two lives, history of, *ib.*
- Amazon river, largest in America, its course, &c., i. 125.
- Ambergris, a perfume obtained from the cachalot, ii. 261 and 262 *n*.; how obtained, 262 *n*.
- Ambrose, St. his credulity with respect to the halcyon, ii. 234.
- Americans, their pains in dressing their hair, i. 204; native, described, 235, 236; characteristics of the race, 235 *n*.; relative position of America, 236 *n*.; its animals compared with those of the other hemisphere, 265; its horses, of what breed, 269 *n*.
- Amia, a fish, noticed, ii. 292.
- Ammodytes, a soft-finned fish, ii. 287.
- Amour, a river of Tartary, i. 124.
- Amphibious quadrupeds, their characteristics, i. 462, 463.
- Amphisbæna, or double-headed serpent, ii. 396; its remarkable motions, *ib.*
- Anaconda, a name applied to all the larger serpents, ii. 398 *n*. See Boa Constrictor.
- Anacreon, his verses on the swallow, ii. 156 *n*.
- Anarchicas, the wolf-fish, ii. 286.
- Andes, volcanoes in the, i. 95 *n*. 94; Ulloa's description of the, 108, 109.
- Androdes or Androcles, the story of, by Aulus Gellius, i. 366 *n*.

- Anemometers, instruments to measure the velocity of the wind, i. 163; their imperfections, ib.
- Anemone, sea, properties of the, ii. 491 n.; *Actinia*, ib.
- Angola breeds of sheep, described, i. 317 n.
- Angora, goat of, described, i. 306.
- Anhima, a kind of crane found in Brazil, described, ii. 174.
- Anhingas, account of the bird, ii. 205 n.
- Animal kingdom, distribution of the, Int. xxxv, xlvii.
- Animal remains, i. 73. See Fossils.
- Animals distinguished from vegetables, Int. xvii, xxxix; how they blend together, i. 183; resemblances of animals and vegetables in affection, ib.; in the climates in which they luxuriate, 184; in the ocean, ib.; how few useful to man, 185; consume one another, ib.; the small numerous, the large ferocious, ib.; their generation, 187; distinguished thereby, 188; some multiplied by cutting, ib. (see Generation.); their comparative perfection, 194; great variety of, 252; use of systematic division of, 253; defects of, 253, 254; systems of different authors, 254, 255; the classification used in this work, 256, 257; formed for enjoyment, 261 n.; the wild and domestic, 264; affected by food, climate, &c., ib.; size of, in different continents, 265; periods of reproduction, 266 n.
- Annelides, Int. xxxviii, xlix.
- Ant, ancient fame of the, ii. 469; modern doubts, ib.; varieties of appearance, ib.; the body of the, described, ib.; display of forces, ib.; divisions in respect of sex, ib.; male and female, ib.; the working class, ib.; their hills, 470; objects of labour, ib.; contests with one another, ib. and n.; female and eggs, 470; maggot state, ib.; care of the female, 470, 471; loss of wings, 471; preparations of the workers for winter, ib.; size of the hills in tropical countries, ib.; the African species, ib.; migrations, ib.; varieties, 472 n.; the wood ant or pismire, how distinguished, ib.; nest and provisions, ib.; architecture of its hill, ib.; changes in its form, 472, 473 n. carpenter ants, why so named, 473 n.; that of South America, ib.; that observed in New South Wales by Captain Cook, ib.; sugar ants of the West Indies, ib.; the white ant, ib.; form and arrangement of their buildings, 474 n.; the worker, ib.; the soldiers, ib.; distension of the abdomen of the queen, 475 n.; hills, their size, ib.; royal chamber, 474 n.; nurseries, ib.
- Ant-bear, one of the animals that live on ants, i. 529; varieties, 530 n.; described, 529; its snout, ib.; mouth, 530; tongue, ib.; helplessness, ib.; residence, ib.; food, ib.; method of taking ants, ib.; manner of defence, ib.
- Antediluvian plants, i. 78 n.
- Antelope, animals of that kind, i. 308 and 321 n.; the class scientifically described, 321 n. and 322 n.; their pasture, flesh, &c., ib.; their beauty, ib.; their eyes, ib.; the antelope described, 312; the Indian, ib. and n.; their herds in India, 312 n.; how hunted, 313 n.; cervine, where found, 323 n.; described by Sparman, ib.; elk, described, ib.; method of hunting, ib.; pigmy, 314 and n.; Scythian, described, 323 n.; its habitations, ib.; striped, described, 313 n.; wood, where found, 323 n.; its size, appearance, &c., described, ib.
- Antennæ of insects, what, ii. 404 n.
- Antioch, earthquakes there, i. 98, 99.
- Antiparos, grotto of, i. 85, 86.
- Antlers of the elk, described, i. 340 and n.; of the rein-deer, 340; of the stag, 327, 328; technical names of the, 331.
- Ant-Lion, ii. 427. See Lion-Ant.
- Ape, the, i. 478; the long-armed or gibbon, ib.; described, ib. and 493 n.; distinctions, 493 n.; dispositions and country, ib.; varieties, ash-coloured, ib.; the little gibbon, ib.; the siamang, ib.; its peculiarities, ib.; assemblies of the, ib.; cry, ib.; active gibbon, ib.; distinctions, ib.; Barbary, its intelligence, 479 n.
- Apera, or Brazilian rabbit, i. 437 n. and 439.
- Aphides, or plant lice, their numbers, ii. 415 n.; varieties, ib.; their enemies, ib.
- Apicius, his method of dressing a hare, i. 429.
- Apodal fish, what, ii. 284; prickly finned, ib.; soft-finned, 286.
- Apoplexy, the parrot subject to, ii. 109 and n.
- Arabia, not the original country of the horse, i. 277 n.; the wild horse of, 270; estimation and treatment of the horse there, 270, 271; its breed of horses introduced into England, 278 n.
- Arachnides, Int. i.
- Arabo, or Cape buffalo, described, i. 299 n.; the habits of the, ib.
- Aras, or maccaws, ii. 110 n.
- Archimedes, his method of determining the purity of gold, i. 118.
- Arequipa, a burning mountain in Peru, i. 94.
- Argali, or wild sheep, the Asiatic described, i. 319 n.; its residence, habits and uses, ib.; the American, ib.; account of, 320 n.; the bearded, ib.; one described by Caius, ib.
- Argentine, the fish described, ii. 289.
- Argonauta, the nautilus of the ancients, ii. 332 and n.; the shell of the, described, ib.; the keeled, ib.
- Aristophanes, his advice about lions, i. 367.
- Aristotle, his account of the halcyon, ii. 236 n.
- Arlotto, a sleep walker, story of, i. 215.
- Armadillo or Tatou, an inhabitant of the new continent, i. 458; its shell described, ib.; method of rolling itself up for defence, 459; bears our climate, ib.; burrows, ib.; their strong resistance when burrowing, ib.; how taken then, ib.; rolls down precipices, ib.; roots like the hog, ib.; lives with the rattle-snake, how, ib.; varieties of the, ib.; the pig-headed, 460; the weasel-headed, ib.
- Arms, human, their shape, i. 206.
- Arnee, a kind of buffalo found in Africa, i. 299 n., the bhain arnee, ib. n.; the taurelephant, ib.; its great size and strength, 300; the common, its characteristics, ib.; weight of one, ib.
- Arrangements, artificial and natural, Int. xii.
- Artedi, his classification of fishes, ii. 283.
- Arteries, Int. xxviii.
- Articulata, Int. xxxvii, xlviii.
- Asia, the original country of the horse, proved, i. 277 n.
- Asiatics, the southern, described, i. 234.
- Asp, a venomous snake, ii. 394 and n.
- Aspic, the viper known under this name, where, ii. 389 n.; the real of the ancients, 394 n. See Haje.
- Ass, its similitude to the horse, i. 280; distinctness of the species, 281; description of the, 280 n.; the wild ass, 280; habits of the wild ass, 281 n.; their food, ib.; flesh of the wild ass eaten by the Persians, 281; wild in America, how hunted, 282; patience of the tame, ib.; habits of the, ib.; bad treatment of the ass general, 283; esteemed in early times, ib. n.; its strength and other qualifications, 283; esteemed by the Spaniards, ib.; once lost in England, now common, ib.; of different countries, ib.; its diseases, age, &c., ib.
- Asterias, or star-fish tribe, described, ii. 491 and n.
- Astracan breed of sheep described, i. 318 n.
- Atalantis, Island of, disappeared, i. 105.
- Athanatus, his strength, i. 209.
- Athelstan, his attention to the improvement of the horse, i. 278 n.
- Athenians, cock-fighting among the, ii. 56; quail-fighting, 76.
- Atherine, description of the fish, ii. 288.

Athol, Earl of, his stag hunt, i. 346 n.; forest of, for red deer, ib.; hunting there how performed, ib.
 Atmosphere. See Air.
 Attitudes of the body express passions, i. 203, 204.
 Attraction and impulsion, influence of, i. 60.
 Attraction, how it produces the tides, i. 136.
 Auk, characters of the class, ii. 215; varieties, ib. and 218 n.; the great auk, an account of, 218 n.; of the little, ib.
 Aurelia or chrysalis, state of ephemera, ii. 438; of the caterpillar, 441—443; operations in that state described, 444—446.
 Auroch, urus, the bison of the ancients, described, i. 296 n.
 Aurora borealis, different kinds of the, i. 178 n.; described, 175 and 178 n.; the Siberian described, 178 n.; identified with electricity, 179 n.
 Aurora monkey, i. 486.
 Aves, Int. xlix.
 Avosetta, description of the, ii. 185; its extraordinary bill, ib.; habits, 185 n.
 Axis, the Sardinian stag, described, i. 333.
 Azotic gas, a component of air, i. 156 n.

B

Baboon, relative position among animals, i. 479; the, described, ib. and n.; its facial angle, 480 n.; its cheeks, colour, disposition, &c., ib.; disposition in the savage state, 480; account of the, at the Cape of Good Hope, ib.; tamed there, ib.; ferocity of one described by Buffon, ib.; food, ib.; internal structure, ib.; varieties, mandril, 481; wanderow, ib. and n.; maimon, 481; dog-faced, 481 n.; size, ib.; are gregarious, ib.; troops at the Cape of Good Hope, ib.; their habits, ib.
 Baby, a dwarf, account of, i. 245, 246.
 Babyroussa, or Indian hog, why classed among the hog kind, i. 355; the, described, ib.; its tusks, ib.; herd together, ib.; dispositions, ib.; food, ib.; country, ib.
 Back, shape of, in man, i. 206.
 Bacon, his remarks on the age of fishes, ii. 247.
 Badger, its appearance, i. 527; habits, ib.; habitation, ib.; carnivorous, ib.; gestation, ib.; the young tameable, ib.; food, ib. n.; the spotted, its colour and habitation, ib.; the American, ib.; its description, ib.
 Bag of some animals. See Pouch.
 Bahama Islands, poisonous quality of the fish caught near one of the, ii. 300; by what caused, ib.
 Bait for fish, what the best, ii. 273; what shell-fish used for, 326 n.; white, account of it, 297 and 304 n.
 Balance, hydrostatical, i. 117.
 Balbuzard, a kind of fresh-water eagle, ii. 33 n.; his prey sometimes taken from him by the pygargus, ib.
 Baldness, where it first takes place, i. 202.
 Balearic crane, ii. 172. See Crane.
 Baltic sea, its inundations, i. 142.
 Ban dog, i. 407 n.
 Banks, Sir Joseph, his method of securing seeds from grubs, ii. 477 n.
 Bantam cock, properties of, ii. 58 n.; account of her Majesty's bantams at Windsor, 58 n.
 Barbary hen. See Hen.
 Barbs, or Barbary horses, i. 271; how trained by the Moors, ib.; Italian sport with the, ib. 272.
 Barbs of certain flat fish, ii. 273, 274.
 Baris, a small tribe of the oran-outang, account of the, i. 477.
 Barnacle, distinguished from the wild goose, ii. 223.
 Barnacle wind-pipe, a singular shell fish, described, ii. 342 n.; the duck, ib. n.; a notion in the Highlands of Scotland respecting the, ib.
 Barometer, instrument to measure the weight of the

air, i. 148; ascertains the height of mountains, 149; theory of the depression of, 149 n.; the green frog used as a, ii. 352 n.; also the leech, 423 n.
 Barretiere, Philip, his long sleep, i. 214.
 Basilisk, prejudices concerning the, ii. 375 n.; how represented by some, ib.; Pliny's statement concerning the, ib.; whence the name, 376; description of that figured by Seba, ib.
 Bass, the resort of the soland goose, described, ii. 205, 206.
 Bastard wing of birds, what, ii. 4.
 Bat kind, animals of the, where placed by different naturalists, i. 460; most resemble quadrupeds, ib.; the, of England, described, ib.; its appearance and habits, ib.; a tame one seen by Mr. White, could rise from the ground, ib.; is torpid in winter, ib.; its retreats, ib.; makes no nest for the young, 461; similitude to birds, ib.; that of our country harmless, varieties of the, ib.; the long-eared, horse-shoe, and rhinoceros bats, ib.; that of the East and West Indies, ib.; formidable, ib.; numerous, ib.; the great, of Madagascar, ib.; described, 462; voracity, ib.; American vampire, ib.
 Bath waters, their antiquity and composition, i. 118 n.
 Bear, varieties, i. 524; characters of the species, ib. n.; the brown, where found, 524; solitary animal, ib.; its den, ib.; sleeps during the winter, ib.; gestation, ib.; voice, ib.; capable of instruction, ib.; not tameable when aged, ib.; hunted, ib.; the black of America, how distinguished, 525 n.; food, ib.; climbing, ib.; eats fish, ib.; its abode, ib.; how caught by the Indians, ib. and 524; habits, 526 n.; the grizzly, its country, ib.; description, ib.; hair, ib.; eyes, ib.; tail, ib.; claws, ib.; a formidable animal, ib.; the five-fingered described, ib.; Malay, ib.; Thibet, ib.; the Bornean, 527 n.; the white Greenland, distinguished, 524; its size in cold climates, 525; how shot, ib.; abundance, ib.; haunts, ib.
 Beard, customs of nations in the manner of wearing the, i. 204; diversities in respect of the, among different nations, 241 n.
 Beauty, female, when it is perfected, i. 200; tastes of different nations in regard to, ib.; Darwin's theory concerning, 206 n.; of the human figure, 207.
 Beaver, the remains of brutal society, i. 465; its disposition, ib.; singularities in its form, 466; their assembling, ib.; formation of a dike, ib. and n.; their apartments described, 467; provisions, ib.; how caught, 468 and n.
 Bee, Reaumur's diligent researches into the history of the, ii. 455; three kinds in every hive, ib.; the labouring, ib.; the drone, 456; the queen bee, ib.; structure of the bee, ib.; teeth, ib.; how it collects wax, ib.; Hunter and Huber's experiments, 456 n.; the belly described, 456; honey-bag, ib.; sting, ib.; community of the, ib.; four companies in constructing cells, ib.; form of the cells, Int. xxxiv. ii. 457; passages, 457; uses of the cells, ib.; manner of constructing the combs, ib.; honey cells, ib.; food, ib.; stomachs, ib.; bee bread, 458; honey, whence extracted, ib.; eggs, ib.; the bee's care of the worm, 459; labours of the worm, ib.; transformations, ib.; the young bees, ib.; swarming, ib.; settling, 460; labours, ib.; slaughter of the drones, ib.; number of swarms, ib.; rearing of bees, ib.; floating beehouses in France, 461; their wax, ib. and n.; arts in using the propolis, 461; honey, ib.; the bee of Guadeloupe, ib.; the humble, 462; the wood, 462, 463 and n.; the ground, 463; the leaf-cutting, ib.; the poppy, ib. n.; the wall, 463, 464.
 Beetle, characteristics of the class, ii. 475; transmutations, ib.; analogy to shell-fish, ib.; cases of their wings, ib.; differences in size, ib.; dor-

- beetle (See May-bug); general characteristics, 477, 478; the elephant, where found, 478; its horns and proboscis, ib.; the exploding beetle, 481 n.; the musk, ib.; the larger musk-scented green capricorn, ib.; the rhinoceros, ib.; the Goliath, ib.; the Midas, ib.; the kangaroo, 482 n.; the golden, ib.; the stag, ib.; the violet, ib.; the elk-horned stag-chaffer, ib.; the great stag beetle, ib.; the water beetle tribe, ib.; the marginated water beetle, ib.
- Bell. See Diving-bell.
- Bellows fish, the, noticed, ii. 282 n.
- Belly of the opossum. See Pouch.
- Beluga, described, ii. 264 n.; is a gregarious animal, ib.; description of one killed in the Forth, ib.
- Bernard, St., convent of, its hospitality to strangers, i. 404 n.; sagacity and enterprise of the dogs there, ib.
- Bewailer. See Sai.
- Bezoar, German, a concretion found in the stomach of the chamouis, its supposed properties, i. 310; described, 311; oriental and occidental, ib.; hog, 312.
- Birds, their adaptations, ii. 3; conformation, ib.; feathers, ib. 4; wings, 4; muscular power of their wings, 5 n.; head, 5; their internal structure, 6, 7; incubation, 8; nest, ib. n.; hatching, 9; emigration, 9, 10, and 11, 12 n.; longevity, 13; domestication, ib.; classification of, 13, 14; according to Linnaeus, 14, 15; rapacious, their general characteristics, 26 and 27 n.; their use, 26; adaptation, ib.; habits, 26, 27; their fecundity small, 27; superiority of the female, ib.; classification of, ib.; of the poultry kind, their utility, 54; characteristics, ib.; sociability, ib.; love of eating, ib., 55; sensuality and infidelity, 55; habit of dusting themselves, ib.; of the pie kind, 77; of the sparrow kind, 120; voices of birds, 125; why they sing, 122 n.; note of alarm, 123 n.; of the crane kind, 164; influence of birds on the imagination, 235; compared with fishes, 244 n.; the females change their plumage, 65 n.
- Bird-catching, how performed, ii. 121.
- Biscayneers, their method of whale-fishing, ii. 255, 256.
- Bison described, i. 291; where found, ib.; usefulness among the Hottentots, 292; diversities of, 296—298 n.; colossal species of the, found in the diluvian strata, 296 n.; described by Cuvier, ib.; the American described, 297 n.; its habits, ib.; how hunted, ib.
- Bisons, fossil, described, i. 298 n.; where found, ib.; bombifrons, ib.; specimen where found, ib.
- Bitch. See Dog.
- Bittern, dismal note of the, ii. 180; the bird described, ib.; its windpipe, ib.; habitudes, ib.; flesh, 181; varieties, ib. n.; referred to by Thomson, Southey, and Scott, ib.; its courage, ib.
- Bivalve shell-fish, ii. 324 and 333.
- Blackbird, the, described, ii. 126; habitudes, 129, n.; note, nest, and food, ib.
- Blackcap, its loud note, ii. 137; the, described, ib. n.; migration of the, ib.; incubation, ib.; note of the, described, ib.
- Black cock, ii. 70, n.
- Black vomit, fatal symptom of the Chapotonadas, i. 153.
- Blenny, account of the fish, ii. 385.
- Blindness, progress of the perceptions of a person having it removed, i. 217, 218; history of a boy blind and deaf, 223, 224 n.
- Blindworm, a harmless reptile, described, ii. 396, 397; motion, 397; eyes, ib.; viviparous, ib.
- Blood, how affected by the air, Int. xxviii., i. 55; its colour, 55.
- Blood hounds, employed by Columbus to hunt the Indians, i. 399 n.; the Scottish, 406 n.; laws concerning the, ib.; English, 383.
- Bluebird, its colour and change of, ii. 126; note and articulation, ib.; how caught, 127; haunts, ib.; note of the red-breasted American, 134 n.
- Blushing, how produced, i. 203.
- Boa Constrictor, the, described, ii. 397 n.; account of one killing a man, ib.; of one shot by Captain Stedman, 397, 398 n.; the manner of the life of those kept in the tower, 398 n.
- Boar, wild, described, i. 348; their strength and method of defence, 349; how hunted, ib.; one tamed by M. De Dieskau, ib. n.; a native of Britain, 350.
- Bobak, the marmout in Poland, i. 437.
- Body, human, its figure, i. 207; size, ib.; weight, ib.; strength, 208—210.
- Boiguaca, a great serpent, described, ii. 397; habits, ib.
- Bombardier, or exploding beetle, described, ii. 481 n.; its explosions, ib.; how produced, ib.; how used in defence, ib.
- Bonassus, a name of the bison, i. 291.
- Bones, composition of the, Int. xxvi.; visited by the blood, i. 228; experiment proving this, ib.; how affected by age, ib.
- Bonet Chinois, a kind of monkey, i. 485.
- Bonito, the fish, described, ii. 292.
- Booby bird, why so called, ii. 214.
- Bottom of the sea, changes produced there, i. 145; nature of, in the Red sea, ib.; near America, ib.; nature of, in general, ib.
- Boyuna, serpent of Ceylon, how regarded there, ii. 396.
- Brachiopoda, Int. xlix.
- Braidwood, Thomas, Edinburgh, taught the deaf, i. 223 n.
- Brain not proportioned in size to intellect, Int. xxxv.; first seen in the embryo, i. 216.
- Brambling, a kind of finch, ii. 150 n.
- Bramins, sensibility of their sense of smell, i. 225.
- Breast, human, its form, i. 205, 206; female, 205; its beauty, ib.; said to be the origin of our ideas of beauty, 206 n.
- Breezes. See Land and Sea Breezes.
- Brisson, his classification of animals, i. 255.
- Bruce, his account of the rhinoceros, i. 513 n.; his encounter with a hyæna, 410 n.
- Bubalus of the ancients, of the cow kind, i. 291; the cervine antelope supposed to be the, of the ancients, 323 n.; a kind of gazelle, described, 313.
- Buckland, Professor, his conjectures concerning the fossil hyæna, i. 411.
- Buffalo, distinguished from the cow, i. 293; described, 298 n., 299; their habits, 298 n.; instance of their docility, ib.; antipathy to red, ib.; the Cape, described, 299 n.; its fierceness, ib.; uses of, 293; native country of, ib.; dangers from the, in a wild state, ib.; method of escaping, ib.; the domestic, its stock, 300 n.; history, ib.; docility and uses, ib.; state of, in Bengal, ib.; in Italy, ib. 294.
- Buffon, his system of natural history, 58; theory of the earth, i. 71, 72; character of, 73; his opinion concerning the formation of fossils, 75; his speculations concerning generation, 187; his description of the perceptions of a man imagined newly created, 226—228; his mistakes concerning American animals, and the panther in particular, 374 n. and 375 and n.; his opinion concerning the camel, 519.
- Buffoon bird, the demoiselle, ii. 174 and n.
- Bug, the, its habitudes, ii. 416; the bed, 417 n.; the leek-green, ib.; abounds in France and Italy, ib.; the animal described, 417; copulation, young, and eggs, ib. and n.; antidotes, 417.
- Bull, the wild or urus, described, 290, 291.
- Bull-dog, the, described, i. 407 n., 384, 385.
- Bull's eye, a kind of cloud prognosticating a hurricane, i. 264.

- Bullfinch**, characteristics of the, ii. 150, 151 n.; its cry in a state of nature, ib.; taught to articulate, ib.
- Bullhead**, or *Cottas*, a fish, ii. 286.
- Bullock's exhibition of reindeer**, i. 341 n.
- Bunting**, distinctive properties of the, ii. 152 n.; power of cracking nuts, ib.; the yellow, described, ib.; the foolish, ib.; the girl, ib.; the reed, ib.; the common, ib.; the ortolan, ib.; how fattened, ib.; the snow, 153 n.; white plumage in high latitudes, ib.; the Whidah, 151 n.
- Bunting**, black-throated, its note, ii. 134 n.
- Burchell**, his account of an encounter with an African lion, i. 363, 364 n.
- Burnet**, Thomas, his theory of the earth, i. 68, 69.
- Burrampooter**, its source, size, and course, i. 128 n.
- Bustard**, its size and properties, ii. 67; where found, ib.; food, ib.; difficult to be shot, and why, 68; chased by greyhounds, ib.; the pouch of, a reservoir for water, ib. and n.; incubation, 68; varieties, ib. n.; food in winter, 68; the little described, ib. n.; the florakin, 69 n.
- Butcher bird**, the species classed, ii. 47; the lesser or red-backed, 48 n.; the greater, 47; marks of the, ib. and 48 n.; its intrepidity, 47; prey, ib.; method of catching its prey, ib.; nest of the, 48; varieties, ib.; habits of the, ib. n.; used in hunting, ib.; Bell's account of the habits of the tame, ib.; called also shrikes, ib.
- Butterflies**, their disappearance during winter, ii. 241; some live through it, ib.; efforts of the, to escape from the chrysalis state, 445; rapid growth of the wings, ib.; their food, 446; beauty, ib.; distinctions, ib.; numbers, ib.; varieties, 449 n.; the large white, ib.; account of the marsh fritillary, ib.; of the peacock butterfly, ib.; of the purple emperor, ib.; of the nettle tortoise shell, 450 n.; of the wings of butterflies, 446; of their body, 447; head, ib.; eyes, ib.; horns and trunk, ib.; nocturnal or moth flies and diurnal, ib. and n.; their enjoyments, 448; male and female, ib.; eggs, how deposited, ib.; and attached, ib.; season of laying, 449.
- Buzzard**, a kind of falcon, the common described, ii. 43 and 46 n.; varieties, ib.; the rough-legged, 46 n.; the honey, ib.
- C
- Cabai**, i. 354. See *Capibara*.
- Cachalot**, distinctions among the varieties of the tribe, ii. 260; size, ib.; properties, 261; pursued for its spermaceti and ambergris, ib.; how these substances obtained from it, ib. 262 and n.; the blunt-headed, 261 n.
- Cagui**. See *Saki*.
- Calabria**, earthquake at 1638, i. 99—101; 1783, 102 n.
- Calandre**, a kind of lark, ii. 139 n.
- Calao**, or horned Indian raven, ii. 82.
- Calculation**, Int. ix.
- Calcutta**, manner of hunting the jackal there, i. 395 n.
- Calf**, the young of the stag, i. 327.
- Call birds**, how used by the bird-catcher, ii. 122.
- Callitrix**, kind of monkey, noticed, i. 485.
- Callyonomus**, or *Dragonet*, account of the fish, ii. 285.
- Calmucks**, a Tartar race, described, i. 233.
- Cambrian system**, i. 83 n.
- Camel**, distinguished from the dromedary, i. 517 and 519 n.; climate, 517; body of the, 519 n.; hair, ib.; reared in Italy, ib.; gestation there, ib.; how broken there, ib.; seven callosities of the, 520 n.; marks of servitude, ib.; use of in hot countries, ib.; fitness for travelling in desert countries, 517; does not multiply in cold countries, ib.; uses to the Arabian, ib. 518; docility, 518; structure of its stomach, ib.; use in commerce, ib.; patience, ib.; Buffon's opinion concerning the, 519; the hump, 520 n. 519; produce of the animal to the Arabian, 519.
- Cameleon**, the, described, ii. 373; swelling and contraction of itself, ib.; the skin, 374; protuberances, ib.; its remarkable change of colour, ib., the colours described, ib. and 376 n.; inspires when it changes colour, 376 n.; on what the change depends, ib.; account of some by Le Bruyn, 374; seldom opens its mouth, ib.; turns one eye towards a different direction from the other, ib.
- Camelopard**, or giraffe, its extraordinary size and appearance, i. 515; measurement of one, 516; timidity, ib.; scarcity, ib.; ten exhibited by Pompey, ib.; errors of zoologists concerning the, ib. n.; account of one by Le Vaillant, ib.; account of one sent to France, ib.; of one sent to Windsor, its measurement, 517 n.; disposition &c., ib.
- Canapual**, Economic, described, i. 444 n.; manner of transporting their food, 445 n.
- Camper**, his scale for intelligence of animals, i. 490 n.; its fallacy, ib.
- Cananites**, their horses, i. 277 n.
- Canary bird**, whence brought, ii. 144; original colour and varieties, ib.; its song, 145; intelligence, ib. n.; account of the feats of one in singing, dancing, &c., ib.; rules for choosing the bird, 145; breeding of the bird, ib. 146; method in Germany, 146; common apparatus, ib.; mixed breed with the linnet, ib. 149 n.; a talking one, 145 n.
- Cancerous sores**, account of some cured by a toad's sucking them, ii. 357.
- Cane Del Grotto**, noxious effects of the atmosphere in, i. 89.
- Cantharis**, the, or Spanish fly, a kind of beetle, described, ii. 479; where found, ib.; food, ib.; Cantharides, how prepared, ib.; their effects, ib.
- Capibara**, account of, the hog kind, i. 354; removed to the genus *cavia*, ib. n.; its resemblance to the hog, 354; description of the, ib.; frequents rivers and lakes, ib.; taste of its flesh, 355.
- Capillary vessels**, Int. xxix.
- Capons**, used for clutching chickens, ii. 57.
- Caracal**, where found, i. 376 n. and 379; how connected with the lion, 376 n. and 379; prey of the, ib.; its size and description, 376 n.; account of one which died in the Tower, 379.
- Carapo**, or electric eel, notice of the, ii. 286 and n.
- Carbonic acid gas**, a component of air, i. 157 n.
- Carboniferous system**, i. 83 n.
- Carcajou**, name of the glutton in North America, i. 423; see *Glutton*.
- Cardan**, his notice of a sagacious elephant, i. 508 n.
- Carli**, Father, how tended by monkeys, i. 484.
- Carp**, the, described, ii. 291 and n.; habits of, 291 n.; where found, ib.; size, ib.; fed out of water, 293; growth of the, 297.
- Carpenter**, or wood bee, described, ii. 462; choice or formation of her hole and nest, ib. and n.; cells described, 462 n.; eggs and young, 463; carpenter ant, 473 n.
- Carrier pigeon**, described, ii. 113; experiments, showing the velocity of its flight, 114 n.; how used to overreach the lottery, ib.
- Carthage**, unwholesomeness of the air there, from heat, i. 153.
- Cartilaginous fishes**, why the tribe so named, ii. 265; distinctions of the, ib. 266; double capacity of breathing, and organs for, 266; generation, ib.; various methods of bringing forth, ib.; anomalous, 279; characteristics and classification of, 265, 266; flat fish, 270.
- Cassowary**, its country and climate, ii. 19 and 21; description of the, 19; its remarkable head, 20; its internal parts, ib.; quiet disposition, ib.; voracity, 21; scarcity, ib.; description of a species of the, found in New Holland, ib. n.
- Cat kind**, animals of the, their properties, i. 356 and ii.

- n.; their resemblance to one another, *ib.*; their claws, *ib.*; teeth, 357; manner of seizing their prey, *ib.*; dispositions, *ib.*; animals of the difficulty of distinguishing the, 374; some blend with the dog, 375 n.; harmony between their dispositions and powers, *ib.*
- Cat, dispositions of the, *i.* 357; form and habits, *ib.*; generation, *ib.*; prey, *ib.*; patience, 358; form of their eye, *ib.*; how far tamed, *ib.*; other habits, *ib.*; cat of the New Continent, 359; what qualities it has lost by domestication, 360 n.; instances of the, catching fish, *ib.*; proofs of their power of fascination, *ib.*; curiosity of the, *ib.*; memory of the, *ib.*; attachment of, *ib.*; to horses, *ib.*; how far broken, 361 n.; sagacity in the, *ib.*; electricity of the, *ib.*; whether they suck infants' breath, *ib.*; their attention to temperature, *ib.*
- Cat fish, notice of the, *ii.* 285.
- Cat lion, or of Angora, described, *i.* 359.
- Cat, wild, a variety of the tame, how distinguished, *i.* 358; its abodes, *ib.*; internal characteristics, 359.
- Catacombs, Egyptian sepulchres, account of the, *i.* 250.
- Catamountain, or tiger cat, described, *i.* 376; its fur, *ib.*; its fierceness, 378.
- Cataracts of rivers, *i.* 126, 127.
- Caterpillar class, different tastes with respect to the, *ii.* 440; beauty in the butterfly state, *ib.*; how distinguished, *ib.*; numerous transformations, *ib.*; egg state during winter, 441; aurelia state, *ib.*; varieties, *ib.*; appearance when it breaks the egg, *ib.*; the body described, *ib.* 442; varieties, 442; stigmata or breathing holes, *ib.*; intestines, *ib.*; change of the skin, *ib.*; how performed, 443; change into the aurelia or chrysalis state, *ib.*; operations in the aurelia state, 444; change from it may be retarded or hurried, 445; further transmutation into the butterfly, *Int.* xxix. and *ii.* 445. (See Butterfly); its enemies, 450; kill one another, 451; receptacles for the eggs of other flies, *ib.*
- Caucasian race of men, its characteristics, *i.* 240 n.
- Caverns in the earth, *i.* 84—86; origin of, 86.
- Caviar sturgeon, discriminated, *ii.* 278; the caviar, whence furnished, *ib.* 279; how prepared, 279; caviar from the mackerel, 302 n.
- Cavy kind, a class of animals, its distinctions, *i.* 437 n.
- Cayman, the, or alligator, distinguished from the crocodile, *ii.* 363 and 367 n.; the term how come into use, 368 n.; the pike-muzzled described, *ib.*; the spectacled, *ib.*; great size of some, *ib.*; the cayman with osseous eyelids, *ib.*; its boldness and terrific roar, *ib.*
- Cayopolin, or Mexican opossum, described, *i.* 497, 498 n.
- Cellular tissue, *Int.* xix.
- Celsius, his thermometer, *i.* 119 n.
- Centipede, a name of the scolopendra, *ii.* 421; the great, *ib.* n.; its venomous properties, *ib.*
- Centipede, electric, its luminous tract, *ii.* 479 n.
- Centiscus, a kind of fish, why so named, *ii.* 281; the scaly described, 282 n.
- Cephalopoda, *Int.* xlix.
- Cepola, the fish described, *ii.* 285.
- Ceres and Pallas, lately discovered planets, theory concerning in Brewster's *Encyclopædia*, *i.* 63 n.
- Cetaceous fishes, called the great beasts of the ocean, *ii.* 249; why ranked as fishes, *ib.*; analogy to quadrupeds, *ib.*; manner of breathing, *ib.*; senses, *ib.*; young, 250; maternal tenderness of, *ib.*; distinctive marks of the tribe, *ib.*; and of its subdivisions, *ib.* See Whale.
- Chabin, an animal said to be bred between the sheep and the goat, *i.* 301 n.; whence the notion of the, *ib.*
- Chætodon, or cat-fish, discriminated, *ii.* 285.
- Chaffinch, their migration described, *ii.* 126; the, described, 150 n.
- Chain of Beings, *Int.* li.
- Chalk formation, *i.* 83 n.
- Chalybeate waters, their properties, *i.* 118 n.
- Chamois, its properties, *i.* 308; where found, *ib.*; acuteness of its senses, 309; its voice, *ib.*; its actions when alarmed, *ib.*; beauty of its eyes, *ib.*; the animal described, *ib.*; its motions, *ib.*; how hunted, 309, 310; its skin, 310; what parts of the, said to be medicinal, *ib.*
- Chamois hunters, their labours and dangers in the hunt, 310 and n.; conversation of Saussure with one, 310 n.
- Channel of rivers, the form of the, *i.* 122; effect of incumbrances on the, 123; rendered navigable, 126.
- Chapotonadas, a malignant distemper, *i.* 153.
- Character, what meant by the word, *Int.* xi.; subordination of, *Int.* xii.
- Charles, I. of England, his body found embalmed, *i.* 252 n.; established horse races at Newmarket, 280 n.
- Charles XII., his action on being shot, *i.* 231.
- Chase of the stag in Scotland, *i.* 345—347 n.; in England, 331, 332; technical language employed in the, 331; the chase anciently, 333; in Sicily, *ib.*; in China, *ib.*
- Chasms in the earth, *i.* 82, 83; in mountains, 110.
- Chat genus, *ii.* 141 n.; the white ear, *ib.*; the stone, *ib.*; the whin, *ib.* and 142 n.; yellow breasted, mimicry of the, 133 n.
- Chatterer, account of the, *ii.* 190.
- Chemistry, objects of, *Int.* viii.
- Cherkh, a Persian hawk, *ii.* 46 n.
- Cheselden, his account of the perceptions of a boy who was restored to sight, *i.* 217, 218.
- Chetah, or hunting leopard, its characteristics, *i.* 375 n.; size *ib.*; colour and shape, 377 n.; its habits, *ib.*; its habitations, *ib.*; mistakes concerning the, rectified, *ib.*
- Chevrotin, or little Guinea deer, *i.* 313 n.
- Chickens, method of hatching in stoves, *ii.* 57; clutched by capons, *ib.*
- Chigoe, a kind of flea, in America, *ii.* 413 n.; enters the skin, *ib.*; how extracted, *ib.*
- Child in the womb, history of the, *i.* 192—194; state of when born, 195.
- Childers, the horse, speed of, *i.* 275; his history, *ib.* n.; cotemporaries of the same name, *ib.*
- Chimpanse, or Troglodyte, account of two of that class, *i.* 475 n.
- Chinchilla, the, resembles the jerboa, *i.* 533 n.; account of the one belonging to the Zoological Society, 533, 534 n.
- Chinese, the, described, *i.* 234.
- Chough, Cornish, account of the, *ii.* 81.
- Chrysalis, change of the caterpillar into that state, *ii.* 443; meaning of the term, 444; state of insects described, 404 n.
- Chub, the different names of the fish, 291, 292 n.; whence named, 292; the, described, *ib.*; its haunts, *ib.*; habitudes, *ib.*; size, *ib.*; spawn, *ib.*
- Chyle, *Int.* xxvii.
- Chyme, *Int.* xxvii.
- Cicade, the ancient, how distinguished from the grasshopper, *ii.* 429.
- Circular system, *Int.* lii.
- Cirrhopoda, *Int.* xlix.
- Civet, varieties of the, *i.* 421; its form and colours, 422; its pouch described, *ib.*; how the perfume obtained, *ib.*; where reared, *ib.*; the perfume at Amsterdam reckoned the best, *ib.*; quantity of perfume obtained, *ib.*; commerce in its perfume, *ib.*; its food, *ib.*; its dispositions, *ib.*
- Class, what, *Int.* xi.
- Classification of animals, by different authors, *i.* 254, 255; that used in this work, 255—257; remarks

- on its utility, 370 and n.; of fish, remarks on the, ii. 321.
- Clavicles, or collar bones, to what animals peculiar, i. 205.
- Cleopatra, what serpent caused her death, ii. 394 n.
- Climate, effects of, i. 152; its influence on animals, 264, 265, 361.
- Clouds, how produced, i. 170, 171; how converted into rain, 171, 172.
- Cluster polypes, ii. 498 n.
- Coal pit, its origin, i. 76 n.; in England abounds in petrified plants, 77 n.
- Coan, a dwarf, account of, i. 245.
- Coati, a kind of monkey, i. 486.
- Coatimundi, a kind of weasel, i. 529 n.; its description, ib.; is tamed, ib.; mode of sleeping, ib.
- Cobra di Capello, or hooded serpent, account of the, ii. 394 and n.; its poisonous bite, ib.; remedies for the, ib.; the petro de cobra, or serpent stone, 394.
- Cochineal, the insect described, ii. 480; food, ib.; how taken care of and nursed, ib.; whence the different colours, ib.; uses of the, ib.; the male a fly, ib.
- Cochlearia, the snail sties of the Romans, ii. 329 n.
- Cock, early domestication and varieties of the, ii. 55; original country, ib.; where found wild, ib.; ancient estimations of its colour, ib. 56; boldness of several breeds, 56; salacity of the, ib.; its voice, 58 n.; varieties of the domestic, the crested, ib.; Turkish, and Bantam, ib.; the Dwarf, 59 n.; Jago, ib.; Paduan, ib.; other varieties, ib.
- Cock of the wood, ii. 69, 70 and n.; see Wood-cock.
- Cock-fighting, early practised, ii. 56; an ungenerous amusement, ib.
- Cockatoo, kind of parrot, ii. 110 n.
- Cockchaffer, eaten by the crow, ii. 87 n.; its manner of laying its eggs, 477 n. See May-bug and Grub.
- Codfish, the, discriminated, ii. 287; its peregrinations, 294; easily taken, 299; Newfoundland codfishery, 300, 301 n.
- Cold, effects of, on water, i. 115; on the atmosphere, 153; how it acts in increasing and refining fur, 414.
- Collar bones, peculiar to man, i. 205.
- Colouring of shells, how accounted for, ii. 323.
- Colours, aid our ideas of distance, i. 218; the variable, of the camelion, described, ii. 374 and 376 n.
- Colubri, the venomous and the inoffensive discriminated, ii. 386 n.
- Comets, i. 60; their phases, 63 n.; opinions concerning, 64 n.; concerning the tails of comets, ib.
- Compagnol, Economic, a kind of mouse, described, i. 444 n.; where found, ib.; habits, ib.; migrations of the, ib.
- Complexion, different, of the human race, i. 236; which colour preferable, ib.; how produced, 237, 240 and n.; five varieties of the complexion of the skin, 240, 241 n.; other gradations, 241 n.; darkened by cold, &c., ib.
- Compression of water, i. 115; experiments on compression of fluids, by Mr. Canton, and results, 115 and 119 n.
- Conchology, fossil, i. 78 n.
- Condoma, or striped antelope, described, i. 313 and n.
- Condor of America, whether of the eagle or vulture kind, ii. 33; size and strength, ib.; description of, as seen by Condamine, 34; Labat's account, ib.; account of one by Mr. Strong, ib.; by P. Feuille, ib.; whether the same as the Arabian Rock, and others, ib.; corrections of mistakes concerning the, 35 n.; effects of age on the, ib.; the parts of the animal described, ib.; its real size, ib.; belongs to the chain of the Andes, 36 n.; its eggs, ib.; prey, ib.; tenacity of life, ib.
- Conepate, a variety of the stinkard, i. 420.
- Conferva rivularis, Int. xlii.
- Coniferae, Int. xliii.
- Coot, the, discriminated from the water-hen and other birds, ii. 193, 194; habitudes of the, 194.
- Coral, what kinds found in a fossil state, i. 75; islands, 104 n.; plants, where found, ii. 494; their appearance, ib.; to what kingdom they belong, ib.; different opinions, ib.; the plant examined, 497; its inhabitants, ib.; experiments on the formation of the, ib.; varieties, ib. and n.
- Coralline genus of insects described, ii. 498 n.; the pencil, ib.; the map, ib.
- Corbet, Peter, superintended the destruction of wolves in England, i. 390 and n.
- Cordier, M., his investigation concerning subterraneous heat, i. 101, 102 n.
- Corin, a kind of gazelle, i. 311.
- Cormorant, size and description of the, ii. 203; appetite, ib.; fetid odour, ib.; how used in fishing, ib.; how used for fishing in China, 203 and 204 n.; account of the Chinese, 204 n.; common on our sea coasts, ib.; how it dries itself, ib.; the lesser and other varieties described, 205 n.; bird's activity in pursuing its prey, ib.
- Cornaro, his life prolonged by temperance, i. 229.
- Corn-crake, or land-rail, account of the bird, ii. 196 n.
- Corrira, a bird of the crane kind, its long legs, ii. 185.
- Corruption of dead bodies, how caused, i. 250; how prevented, ib.
- Corvorant, account of the, ii. 204 n.; see Cormorant.
- Coryphæna, or Razor fish, noticed, ii. 285.
- Cotopaxi, volcano of, i. 94, 95 and n.
- Cottus, or Bullhead, a prickly finned fish, ii. 286.
- Couando, distinguished from the porcupine, i. 456.
- Cougar, or Red Tiger of America, described, i. 370; formidable nature, ib.; its habits, ib.; how encountered, ib.; combats with the crocodile, 370, 371; where found, ib.; flesh of the, 371.
- Coulterneb, the Puffin, why so called, ii. 215.
- Cow kind, animals of the, i. 289; characteristics, ib. n.; usefulness, 289; food, ib.; teeth, ib.; age, how known, ib.; horns, 290 and n.; English breed of the cow, how improved, 290; how affected by its pasture, ib.; differences in its size, ib.; form, ib.; originally of a common stock, ib.; different races of the, 290, 291 n., 295 n.; the Tartar and Turkish breed described, 295 n.; Egyptian, ib.; Caffre, ib.; Danish, ib.; British breeds described, long-horned, ib.; short-horned, ib.; middle-horned, ib.; polled breeds, ib.; Highland, ib.; Fifeshire, ib.; Welsh, 296 n.; Alderney, ib.; in Iceland, 291; other countries, ib.; that with the hump, 292; (see Bison); how to distinguish the classes of this kind, 294; an animal uniting the characters of the hog and, ib.
- Crab, the resemblance of its habits to those of the lobster, ii. 306; where found, 310; the, described, ib.; account of the violet land-crab, ib.; strength of its claw, ib.; orderly society and march, ib.; casting of the spawn, 311; return, ib.; casting of the shell, ib. and 307 n.; in the mountains impregnable, 311; uses of, ib.; the sand crab described, 312 n.; the red-mottled, ib.; the rough-shelled, ib.; red-clawed, ib.; the pea, ib.; the common, ib.; the velvet, 313 n.; the horrid, ib.; the spider, ib.; the land crabs of Jamaica, ib.; their abundance, ib.; sold by the Negroes, ib.; eaten by swine, ib.; the black and white varieties there, ib.; account of an extraordinary production of, in 1811, ib.; the soldier crab described, 311, 312.
- Crab-eaters, a kind of herons, ii. 179 n.
- Crabs-eyes, improperly so called, what they are, ii. 307.
- Crab-stones, what, ii. 308 n.
- Crane kind, birds of the, ii. 164; their distinctive qualities, ib.; legs, ib.; bill, ib.; not domesticated, and why, 165; food, ib.; tribes, ib.; smaller

- birds of the, distinguished, 185; enumerated, *ib.*; their properties, 186; food, *ib.*; adaptation, *ib.*; climate, *ib.*; migrations, *ib.* 187; residents, *ib.*; nestling, *ib.*; method of taking, 188.
- Crane, real dimensions of the, *ii.* 165; fables concerning the, and their origin, *ib.* 166; countries of the, 166; migrations, *ib.*; scarcely ever seen with us, and the reasons why, *ib.*; favourite climate of the, *ib.*; depredations, *ib.* 167; aerial journeys, 167; manner of flying, 166 *n.*; loud cry and its use, *ib.*; the wind-pipe, *ib.*; contests with the falcon, *ib.*; tamed, *ib.*; affection for man, *ib.* and 168 *n.*; popular respect for the, 167; the genus characterized, 169 *n.*; Balearic, doubts concerning the, 172; its remarkable appearance, *ib.*; its country, 173; habits, *ib.*; gigantic, a large species of the stork-genus, described, *ib.* *n.*; its country, *ib.*; food, *ib.*; why venerated by the Indians, *ib.*; habits, *ib.*; Numidian, the Demoiselle, 174.
- Cray or Craw fish, river, *ii.* 309; the species described, *ib.* *n.*; flesh, *ib.*; where found in abundance, *ib.*; how taken, *ib.*
- Creepers, their analogy to wood-peckers, *ii.* 101 *n.*
- Crests or fleshy carbuncles on the beak of the condor, *ii.* 35 *n.*
- Cricetus, or German Rat, the, described, *i.* 447; its pouches, *ib.*; voracity, *ib.*; construction of its abode, *ib.*; its stores, *ib.*; propagation, *ib.*; fur, *ib.*
- Crick, a kind of parrot, *ii.* 110 *n.*
- Crick, the two kinds of, *ii.* 435; the field, *ib.* and *n.*; its abode described, habits by White, *ib.*; sound, *ib.*; the house cricket, its sound, 435; residence and habits, 436; how it may be taken, *ib.*; its voracity, *ib.*; the sound of the, how regarded by different persons, *ib.*; how expelled from a house, *ib.*; Sonnets of Keats and Leigh Hunt on the, and grasshopper, 429 *n.*; the mole cricket described, 436; why detested by gardeners, *ib.*; eggs, and young, *ib.*
- Croaking of the bull-frog described, *ii.* 352 *n.*; of the common frog, 350, 351; indicative of wet weather, 351.
- Crocodile, its resorts, *ii.* 362; where largest and fiercest, *ib.*; two varieties, 363; size of the, *ib.*; description taken from one, *ib.*; the internal parts, *ib.*; its habits, 364; strength, *ib.*; on what occasions it seeks the land, *ib.*; manner of seizing its prey, *ib.*; contests with the tiger, *ib.*; how killed by the negro, *ib.*; how taken by the Siamese, 365; managed like a horse, *ib.*; Waterton's account of his jumping on the back of one, confirmed by examples, ancient and modern, 365 *n.*; how taken in Africa, 365; state of the, in Egypt, 366; accounted for, *ib.*; where inoffensive, *ib.*; musky smell of the, *ib.*; flesh, *ib.*; eggs, and manner of breeding, *ib.* 367; whether it devours its young, 367; age of the, *ib.*; produced in the Roman amphitheatres, *ib.* and 368 *n.*; varieties, 367 *n.*; the gigantic described, *ib.*; the Egyptian, *ib.*; used as food, 368 *n.*; venerated by the old Egyptians, *ib.*; in some districts abhorred and killed, *ib.*; why, *ib.*; the double-crested, *ib.*; the crocodile of St. Domingo, *ib.*
- Cross-bow fish, the File fish, why so called, *ii.* 282 *n.*
- Crotali, a class of venomous serpents discriminated, *ii.* 386 *n.*
- Crow, the, its characteristics, *ii.* 78—80; how regarded by man, 84 *n.*; description of their flying, *ib.*; account of a crow roost by Wilson, *ib.*; mischievousness and cunning of the, 85 *n.*; the Royston or hooded, 80 *n.*; fish, 82 *n.*; Clark's, *ib.*; amusing anecdote of one, 86 *n.*
- Crusades, horses employed during the, *i.* 278 *n.*
- Crustacea, *Int.* xlix.
- Crustaceous shell-fish characterized, *ii.* 305; classified, 306.
- Cuckoo, the, described, *ii.* 103 and *n.*; its call, *ib.* female makes no nest, *ib.* and 104 *n.*; egg of the, 104 *n.*; inquiries concerning the cause of its not hatching, 105 *n.*; its food, 103, 105 *n.*; its migrations, 104; appearance and disappearance, 104 *n.*; varieties, 104 and 105 *n.*; the honey guide, 105 *n.*; account of it at the Cape of Good Hope, 106 *n.*; the sacred, *ib.*
- Cuckoo spit, or Froth worm, account of the, *ii.* 437.
- Cud, class of animals that chew the, *i.* 287. See Ruminating animals.
- Culley, Mr., his observations on sheep, *i.* 315—317 *n.*
- Cumbrian system, *i.* 83 *n.*
- Cur dog described, *i.* 402 *n.*
- Curassows, gallinaceous birds, *ii.* 63 *n.*; reclaimed in South America, *ib.*; once acclimated in Holland, *ib.*; desirableness of their introduction here, *ib.*; the crested, described, *ib.*; flocks of, in Guiana, *ib.*; habits of the, *ib.*; the galeated, account of, *ib.*; the razor-billed, 64 *n.*; the guan, *ib.*
- Curlew, the two species of the, *ii.* 188 *n.*; habits, *ib.*; food, 189 *n.*; nest of the, *ib.*; Montagu's account of a tame one, *ib.*; described, 190 *n.*
- Currents of the ocean, their causes, *i.* 138; where most violent, 139; that in the Mediterranean, *ib.*; various, 140.
- Currents of air, some double, *i.* 162. See Wind.
- Cushat, or ringed dove, described, *ii.* 115 *n.*
- Cuttle fish, the, described, *ii.* 492; spurts forth a dark liquor when pursued, *Int.* xxix. and *ii.* 492; varieties and structure of the animal, 492 *n.*; size of the, in hot climates, *ib.*
- Cuvier, his observations on the formation of rocks, *i.* 73 *n.*; his classification of dogs, 397, 398 *n.*; the same explained, 398—408 *n.*

D

- Dab, account of the fish, *ii.* 228 *n.*; when in season, *ib.*
- Dagenham, in Essex, trees discovered by an inundation of the sea there, *i.* 144.
- Damp, or deleterious air, fatal effects of, in mines, *i.* 88; two kinds of, 90 *n.* See Gas.
- Danube, its course and depth, *i.* 124; rivers received by, 125.
- Darkness, how far the eye accommodates to, *i.* 219; story illustrating the subject, *ib.*
- Darley introduces Arabian horses into England, *i.* 280 *n.*
- Darwin, his notion of the source of our ideas of beauty, *i.* 206 *n.*
- Deafness, causes of, *i.* 222; perceptions of one recovered from, *ib.*; state of one born deaf, *ib.* 223; methods of teaching the deaf, 223 and *n.*; account of a boy born blind and deaf, 223, 224 *n.*
- Dead Sea, its saltness, *i.* 133.
- Death, what, *Int.* xiv.; many causes of, *i.* 230; generally calmly endured, *ib.*; not really terrible, 231; reflection in the article of, *ib.*; gradual approach of, *ib.*; uncertainty of the signs of, *ib.*
- Death watch, or Ptinus, described, *ii.* 483 *n.*; its manner of beating, *ib.*; one tamed by Derham, *ib.*; the termes described, *ib.*; where found, *ib.*; manner of producing sound, *ib.*
- Decoys for ducks, how managed, *ii.* 229, 230; value of some, 230; those in Chita, *ib.*
- Deer kind, animals of the, 326—345; properties of the, 326 *n.*; the stag, 327, &c.; quantity of, in Scotland diminished, 346 *n.*; where still found, *ib.*; the large forest of Athol still reserved for, *ib.*; those found among the Grampians, 347 *n.*; (see Stag, Fallow-deer, and Rein-deer); red, or wild stag, 330. See Deer and Stag.
- Defence, methods taken by animals for their, *i.* 263.

- Demoiselle*, why a kind of crane so called, ii. 174 and n.; account of the, ib.; country of the, ib.
- Denham*, Major, his account of the depredations of the hyæna, i. 410 n.
- Depona*, a great serpent of Mexico, the mouth described, ii. 397; the body, ib.; harmless, ib.
- Descent*, measurement of the descent of several remarkable rivers, i. 122 n.
- Description of animals*, its utility and method, i. 257.
- Desman*, the, a kind of musk rat, i. 446.
- Devonshire*, Duke of, account of his elephant, i. 507 n.
- Dew*, how produced, i. 172; how its remaining on bodies affected by their conducting powers, ib. n.
- Dhole*, the, wild dog of the East Indies described, i. 399 n.
- Diableret*, fall of a part of the mountain of, i. 110.
- Diadon*, orbicular, the fish characterized, ii. 282 n.
- Dicynodon*, the, i. 79 n.
- Dicotyledones*, Int. xlviii.
- Digester*, ascertaining the elasticity of air, i. 150.
- Dingo*, dog of New Holland described, i. 398 n.; vertebrae of its tail, ib.; imperfectly domesticated, ib.
- Diseases from heat*, i. 153; from cold, ib.; from moisture, ib.; from effluvia, 154; Boyle's reason for revolutions in, 155; of sheep, 317 n.; of fish, ii. 299.
- Disposition of animals affected by climate*, i. 265.
- Disruptions of mountains*, i. 110, 111 and n.
- Distance*, whence our notions of, i. 217, 218.
- Diver*, the great Northern, its size and colours, ii. 215; the bird described, 217, 218 n.; the speckled, 218 n.; use of wings to divers, ib.
- Diving-bell*, Dr. Halley's, i. 145; a kind of, used by the water spider, ii. 411 n.
- Dodo*, its body, bill, legs, &c. described, ii. 21; country, ib.; flesh, ib.; whether the bird of Nazareth, ib.; now extinct, 22 n.; summary of all known concerning, ib.; Clusius and Willoughby's description, ib.; the figure in Edwards' gleanings, ib.; Morell's remarks on the numbers said to be found in the Isle of France, &c. ib.; Thomson's remarks on the, ib. 23 n.; Duncan's 23 n.; Le-guat's account of the, ib.; reflections, 24 n.
- Dog kind*, characteristics of the, i. 379; habitudes, 380; qualifications of the, ib.; sense of smelling, ib.
- Dog*, the, why not generally used in the chase in the Eastern countries, i. 378; intelligence, courage, and affection of, 380; important uses of the, ib.; to the shepherd, 381; in the chase, ib.; the wild, described, ib.; fidelity of the dog, ib.; diversities of the breed, ib.; original sameness, ib.; internal structure the same, 382; which the original kind, 397 n. and 382; proofs, ib.; a new classification of dogs from Cuvier, 397, 398 n.; these divisions and their varieties described, 398—408 n.; when it regains its instinctive habits irreclaimable, 398 n.; instance in proof of this, ib.;—varieties, Division 1.—characters, 398 n.; the New Holland dog described, ib.; half domesticated, ib.; Dhole, 398 n.; Pariah, ib.; African, South American, Alco, North American, Irish greyhound, 399 n.; Albanian, French mutin, great Danish, Scottish Highland greyhound, Russian greyhound, 400 n.; domesticated dogs, characteristics, gazehound, 400 n.; greyhound, Scotch, Italian, and Turkish greyhound, 401 n.;—Division 2.—characters, 401 n.; shepherds' dog described, 402 n.; cur, Pomeranian, Siberian, Greenland, Iceland, Esquimaux, Newfoundland, 402 n.; Russian water-dog, great rough water-dog, large water-spaniel, small water-spaniel, 403 n.; fowlers—springer, ib. n.; King Charles', pyrame, shock, lion, Alpine spaniel, setters, comforters, 404 n.; pointers, Dalmatian, ib.; hunting by the scent, Scotch terrier, English and South American terrier, old English hound, 405 n.; blood-hound, stag and fox-hound, harrier, beagle, otter-
- hound, bull-terrier, 406 n.; mongrel hounds, lurcher, lemmyer, tumbler, turnspit, ib. n.;—Division 3.—characters, 407 n.; mastiff, ban-dog, bull-dog, pug-dog, small Danish, roquet, mopsie, artoise, 407 n.; old classification, the hound, harrier, and beagle, 382; grey matin, ib.; mastiff, 383; English, classified by Caius, ib.; the Turkish dog described, 384; the Irish wolf-dog described, ib.; Indian dogs, fortitude of the, shown to Alexander the Great, 385; flesh of the, where eaten, ib.; instances of the enmity between the dog and wolf, 386; and the fox, ib.; description of the dog when whelped, ib.; its generation, 387; characteristics of, by Linnaeus, ib. n.; madness of the, 387.
- Dog-butcher*, in China, attacked by dogs, i. 285.
- Dog-fish*, the spotted, of the shark kind, described, ii. 270.
- Dogger sands*, a bank formed by two tides meeting, i. 142.
- Dogs*, Isle of, why so named, i. 401 n.
- Dolphin*, the, described, ii. 262 and 263, 264 n.; varieties of the species, ib. n.; agility of the, ib.; partiality of the ancients to the, ib.; how regarded at present, 263; how wrong drawn by the ancients, ib.; whether they live out of water, ib.; are gregarious, 264 n.; is termed the Sacred Fish, ib. See Porpoise.
- Don*, its course, i. 124.
- Dorado*, the, beautiful colours of the fish, ii. 298, pursues the flying fish, ib.
- Dorcas*, the disciple, whence named, i. 322 n.
- Doree*, a prickly-finned fish, noticed, ii. 286.
- Dormouse*, its varieties, i. 445; habits, ib.; sleeps in winter, ib.
- Dorr-beetle*, or May-bug, account of the, ii. 475, 476. See May-bug.
- Douc*, monkey of Cochin China, i. 485.
- Dove*, (see Pigeon, Turtle, Ring-dove, &c.) ii. 111.
- Dovecots*, account of, by C. Waterton, ii. 119, 120 n.
- Dragon fly*, multiplying and diminishing power of its eye, ii. 405 n.; its beauty, 425; production of the, ib.; first form, ib.; change to the flying state, ib.; its wings, 426; habitudes, ib.; prey, ib.; generation, &c. ib.; the depressed, its colour, &c. ib. n.; the black winged, 427 n.
- Dragon*, flying, of America, ii. 376 n.; described by many under the name of the basilisk, ib.; that of Java, 374.
- Dragonet*, account of the fish, ii. 285.
- Drawings of animals*, Locke's opinion of the advantage of, i. 257.
- Dreams*, how fashioned, i. 213; effects of, 214, 215; sleep-walking, 215; how accounted for, ib.
- Dress*, savages careful with respect to, i. 204; observations concerning, ib. 205; objects pursued in, 205.
- Drill of Purchas*, the oran-outang, i. 475.
- Dromedary*, its distinction, i. 517; where found, ib.; meaning of the word, ib. n. See Camel.
- Drone bees*, described, ii. 456; their slaughter, 460.
- Duck*, the domestic, easily reared, ii. 228; hatched by the hen, ib.; distinguished from the wild, ib.; wild, distinguished, ib.; sea-ducks, ib.; pond, ib.; eider, ib. and 232, 233 n.; tufted, 228; account of the velvet, 231 n.; the scap, ib.; the shieldrake, 232 n.; the mallard, ib.; the long-tailed, ib.; the golden eye, ib.; account of the voyages of the wild-duck, ib.; nest and young, ib.; difficult of pursuit, ib.; nest of the wild-duck in the arctic regions, 229; the down, how obtained, ib.; appearance of the, when it comes among us, ib.; choice of residence, ib.; the call of the, ib.; nocturnal adventures, ib.; how taken by a decoy, ib. 230; manner of taking them in China, 230; summer, the, of America, builds its nest on a tree, 233 n.; and perches, ib.; its pendant crest, ib.; Wilson's account of the nest of one, ib.

Dunlin, the, described, ii. 193.

Dwarfs, i. 244; account of several, ib. 245; of the marriage of two celebrated by Peter of Russia, 245; of Jeffrey, ib.; of Coan, ib.; of Baby, ib. 246.

Dwina river, its course, i. 124.

Dziggtai, an animal of the zebra kind, specific characters of the, i. 286 n.; description, ib.; agility, ib.

E

Eagle, account of one destroyed by a weasel at St. Mary's Loch, i. 425 n.; the abode of the, ii. 28; habits, ib. and 30 n.; not entirely tameable, 28; flight of the, ib. and 30 n.; eye, 28; strength, ib.; prey, ib. and 30 n.; instances of the, taking away children, 29 and 33 n.; formidable when rearing the young, 29; instances of retaliation in the, ib. and n.; the nest of the, described, 29 and 30 n.; plumage and change of colour, 29; food, ib. and 30 n.; varieties, 28, 30; the golden, the common, 30 and 31 n.; bald, 30; white, ib.; rough-footed, ib.; white-tailed, ib.; erne, ib.; black, ib.; sea, ib.; osprey, ib.; Jean le blanc, 31; that of Brazil, ib.; Oroonoko, ib.; crowned African, ib.; that of Pondicherry, ib.; martial, ib. n.; bal-buzzard, 33 n.

Ear, human, remarks on the, i. 204; construction of the, 222.

Earth, its magnitude, i. 60; its situation in the solar system, 65; proofs of its rotundity, 66 n.; exact shape, 66; appearance of its surface, 67; internal structure, 67; theories of the, 68—72, and 72, 73 n.; strata of the, 81; their order, 83 n.; fertility of the, 81; chasms in the, 82, 83; internal heat, 89 n.; changed by the ocean, 140; its defences against the sea, 141; considered in relation to the Deity, 179; varieties of its provision, ib.; the earth gloomy without man, ib.; fitted for his abode, ib.; how subdued to his use, 185.

Earthquakes, i. 97; Amontons' theory of, 98; Woodward's theory, ib.; Cordier's theory, 101 n.; several mentioned, 98, 99; Great Lisbon earthquake, 99—101, and 102 n.; concomitant circumstances, 101.

Earwig, the, described, ii. 436, 437; whence the name, 437; food, ib.; progress to the winged state, ib.

Ecacoalt, the Indian name of the rattlesnake, on what supposition given, ii. 392.

Echineis, or sucking fish, the, ii. 287; how employed by the Indians, ib. n.

Echini, ii. 341. See Urchins.

Echinodermata, Int. 1.

Echo, how caused, i. 158 n.; extraordinary echoes, ib.; cause of the, 222; cannot be made by art, ib.

Economic campagnol, i. 444, 445 n.

Edgar, King, his contrivance to extirpate wolves, i. 390 and n.

Education, different methods of, i. 197; what the best, 198; how to be pursued, ib.; when most rapid, ib.

Edward III. an improver of horses, i. 279 n.

Eel, the, or *Muræna*, ii. 286; account of electric eels, ib. n.; the, descends towards the sea to spawn, 293; migrations of the, 294 n.; viviparous, 297.

Egg, what animals produced from the, i. 189; disposition of substances in the, 190; progress of the animal, in the, traced by Malpighi and Haller, 190, 191; analogies between it and the embryo, 191, 192.

Eggs, Sea, ii. 341. See Urchins.

Egrets, a kind of herons, ii. 179.

Egypt, its appearance during the Kamsin, i. 163 n.

Egyptians, their race determined, i. 235 n.; their embalmings described, 248—250; their sepulchres, 250; their horses, 279 n.; present superiority of their horses 272.

Eider Duck, its class, ii. 232, 233 n.; abodes, 233 n.; the bird described, ib.; its down, ib.

Ekia, or African dog, i. 399 n.; estimation in which its flesh is held by the Negroes, ib.

Elasticity of the air, i. 148.

Eldenhole in Derbyshire, i. 82 and n.

Electric eels, account of, ii. 286 n.

Electricity of the cat, i. 361 n.

Elephant, its appearance, i. 497; size, ib. and n.; description, 498; the two species of the, ib. n.; the Asiatic, ib.; the African distinguished, ib.; strength of the, 498; peaceableness, ib.; gregarious habits, ib.; haunts, ib.; food, ib.; excellence of its senses, 499; the trunk and its uses described, ib. and n.; Cuvier's observations on the trunk, 499 n.; the animal's care of it, ib.; its difficulty of motion and encumbrances, 500; tusks, ib.; its method of eating and drinking, ib.; its hide, 501; the elephantiasis, ib.; where found and how used in different countries, ib.; the white esteemed, ib.; propagation, 502; fails when domesticated, ib.; exceptions, ib. n.; how hunted by Indian princes, 502, 503; hunted in Africa, 503 and 509 n.; at the Cape of Good Hope, 505; period of gestation, 502 n.; Ranking's account of the habits of a young, ib.; affection of the, for its young, 502 n.; instances, ib.; their ferocity in the rutting season, ib.; method of taking the goondah or male elephant by means of the koomkees or females, 506 n.; docility when tame, 503; instances, ib. and 507—509 n.; account of the Duke of Devonshire's elephant, 507 n.; of one called Mademoiselle D'Jeek exhibited in theatres, 507 n.; docility of those of Germanicus, ib.; Seneca's and Dion's account of some, 508 n.; Arrian's account of one dancing, ib.; instances of their being taught to reverence the Pope, &c. ib.; their care in practising feats, 509 n.; used in war, 504; in carrying burdens, ib.; in executions, ib.; trained for baiting, how, described by Heber, ib. n.; instance of the fatal exertion of one, 505; of retaliation, ib.; of gratitude, ib.; ancient and modern commerce in its ivory, 509 n.; reflections, 510 n.; its teeth or tusks, 505 and 509 n.; weight of one, 510 n.; the fossil species, 505 and 510 n.

Elephantiasis, or Arabian leprosy, i. 501; erroneously said to be cured by the bite of a rattlesnake, ii. 391 n.

Elizabeth, Queen, her regulations concerning fasting, i. 212; encouraged the woollen manufacture, 303.

Elk, its country, i. 338 and 347 n.; description of the, 338; its haunts, ib.; how pursued by the Indians, ib.; easily tamed, ib. and 347 n.; history of one, ib.; used in agricultural labour, ib.; size of the, 338; description of one shown at Paris, ib. 339; the American, 339; their climate, ib.; a hunt of the, described, ib.; hunting of, in Canada, 348 n.; its flesh, horns, &c. 339; diseases, 340; mistakes concerning the, ib.; antelope, described, 323 n.; method of hunting, ib.

Elops, or Sea serpent, ii. 286.

Ely, country round, deteriorated by the sea, i. 142.

Embalming, early practised, i. 248; how performed by the Egyptians, ib.; by the Guanches, 249; by the Peruvians, ib.; in France, 251.

Embryo, progress of the embryo in lower animals, Int. xxx.; in man, i. 192.

Emigration of birds. See Birds.

Emu, or American Ostrich, ii. 19; its residence, ib.; description, ib.; Nierenberg and Wafer's accounts of the manner of hatching its young, ib.; see also n.

Encoubert, a kind of armadillo, i. 459, 460.

England, dogs of, variety of the, i. 383; Dr. Caius classification of the, 383, 384; salubrity of its fish ii. 300; apostrophe on its angling pleasures, ib.

Entellus monkey, described, i. 494 n.

Entozoa, Int. 1.

- Ephemera, how long they exist in the fly state, ii. 438; how produced, ib.; described in the fly state, ib.; in the reptile state, ib.; indications of transition, ib.; where seen in abundance after transition, 439; ease and rapidity of transition, ib.; male and female, ib.; eggs, ib.; varieties, ib.
- Equator, earth at the, i. 66.
- Ermine, its size and description, i. 413; its fur and its change of colour, 413, 414; when called the stoat, 413; why its fur refined by cold, 414; its scent and food, ib.; where found and how caught, ib.
- Erne, a species of eagle, ii. 30.
- Eruptions. See Volcanoes.
- Esculapian serpent of Italy, how regarded there, ii. 396.
- Essex. See Pike.
- Esquimaux, their race determined, i. 236 n.; and described, ib.
- Eunuchs, barbarous policy in making, i. 199; in Italy, ib.; described, ib.
- European race of men described, i. 236.
- Eustachian tube, hearing by the, i. 222.
- Evaporation, its importance, i. 127 n.; its amount, ib.; Dobson's experiments concerning, 128 n.; Hoyle's and Dalton's, ib.; of water, how it produces clouds, 171; Hamilton's theory concerning, ib.; how affected by heat, ib.; frost, &c., 172; how affected by night, ib.
- Experiment, Int. ix.
- Expression of the different parts of the human body, i. 200; the face, 201; the eyes, &c., 201—204.
- Eyes, state of them in man at birth, i. 195; their expression, 201; their motions, ib.; colours, ib.; alone varied, ib.; early formed, 216; not exercised immediately after birth, ib.; invert objects, ib.; another error in sight, ib.; benefit of having two eyes, 216, 217; state of the, at different ages, 218; accommodate to light and darkness, 219; different colours of the, in different races, 242 n.; of a cat, 358; of birds, their conformation, ii. 5; the, of insects, how constructed, 404 n.; their multiplying and diminishing powers, 405 n.
- Eyebrows, and eyelashes, their expression, i. 201, 202.
- Eyelids, their use, i. 202.
- F
- Face, human, its energy, i. 201; on what its expression depends, ib.; form of the human, how affected, 238; minute variations of the, endless, 242 n.; classification of the diversities, ib.
- Fahrenheit, his thermometer, i. 119 n.
- Falcon kind, used in hawking, ii. 40; what varieties used in the sport, ib.; the generous, how distinguished, ib.; the gyr falcon, 41; the falcon, ib.; falcon gentil, ib. and n.; the lanner, 41; kestrel and merlin, ib.; their spirit, ib.; method of training the, 41, 42; method of pursuing and taking different animals, 42; the ignobler varieties, 42, 43. See Kite, Buzzard.
- Falcons, the gentle, used in hunting gazelles, i. 314; their manner of pursuing, 315.
- Falcon, Peregrine, indigenous in the Highlands of Scotland, ii. 43 n.; its rapid flight, ib.; the secretary of Africa, described, 44 n.; its food, ib.; method of seizing serpents, ib.
- Falconry, an ancient sport, ii. 40; the hawk on hand in paintings a mark of rank, ib.; expenses of the sport, ib.; how the bird trained for the sport, 41, 42; how distinguished, 40.
- Fallow-deer, distinguished from the stag, i. 334 and n.; their properties, 334; contests of the, ib.; tamed, 335; their gestation, ib. and n.; their method of drinking, 335 n.; the chase of the, 335; their sympathy with the wounded, story of, ib. n.; their varieties, 336; those of Guiana, ib.
- Fangs, venomous, of the serpent, account of the, ii. 396 n.
- Fascination, the, of the rattle-snake, account of, ii. 392 and n.
- Father-lasher, or scorpio, notice of the fish, ii. 285 and n.
- Fauvette, the winter, account of the, ii. 142 n.
- Fawn, the young of the fallow-deer, i. 334; of the roe-buck, 337.
- Feathers of birds, their position and beauty, ii. 3, 4; for beds, whence obtained, 223, 224; how cured, 224.
- Felling colliery, explosion at, i. 91 n.
- Female sex, how treated by savages, i. 199; their privileges in polished countries, ib.; shape of the, 200; their comparative weakness, 210; in general live longer than men, why, 229.
- Ferret, its country, i. 415; the, described, ib.; its climate, ib.; prey, ib.; how used in hunting rabbits, ib.; parturition of the, ib.; sleep of the, ib.; its smell and bite, ib.
- Fibre, muscular, Int. xx, xxi.
- Field-fare, its migratory habits, ii. 128 n.; haunts and disposition, ib. 127.
- Figure, human, its proportions, i. 207.
- File-fish, the long, described, ii. 280, 282 n.; its singular fin, ib.; varieties, ib.; the, described, 342, 343. See Pholas.
- Final causes, Int. ix.
- Finch, the citril, where found, ii. 149 n.; note of the, ib.; reproduction of, with canaries, ib. n.; for other finches, see Goldfinch, Chaffinch, &c.
- Fins of fishes described, with their uses, ii. 241, 242.
- Fire, supported by air, i. 155.
- Fires of St. Helmo, meteors in Jamaica, description of, i. 174.
- Fire-flare ray, ii. 271; its spine, ib.; terrible to fishermen, 273, 274; ancient fables concerning it, 273; used to head arrows, 274; whether venomous, ib.
- Fire-fly, the glow worm of tropical climates, ii. 479 n.; described by Southey, ib.; anecdote concerning the, ib.
- Fishes, their abodes, ii. 241; numbers, ib.; form, ib.; fins, ib.; glutinous covering and scales, 242; smelling, 243 and n.; tasting, 243; hearing, ib.; account of the organ by Hunter, ib. n.; seeing, 243; eye described, ib.; their adaptations compared with birds, 244 n.; appetite, 244; maws and digestion, ib.; can endure want of food, 245; yet voracious, ib.; their hostility to one another, ib.; migrations, ib.; require air, ib.; proofs, ib.; use of the gills, ib.; the air bladder and its use, 246; their age, 247; methods of determining, ib.; extreme fecundity of, ib.; nests of, ib. n.; generation, 248; spawn, ib.; classification, ib.; whether nourishing, 249; why not salt to the taste, ib. and n.
- Fistularia, the fish described, ii. 288.
- Flamingo, its class, ii. 183; properties, ib.; haunts, ib.; in what state found by the Europeans, in America, ib.; disposition now, ib.; venerated by the negroes, ib.; untameable, 184; flesh, ib.; flocks of the, ib.; manner of feeding, ib.; nests and young, ib.
- Flat fish, cartilaginous, ii. 270. See Ray kind, the, or Pleuronectes, 287.
- Flatterers, likened by Shakspeare to the halcyon, ii. 237 n.
- Flea, its agility, &c., ii. 412; its remarkable strength, 413 n.; appearance through the microscope, 413; eggs and young, ib.
- Flea, water, the arborescent, ii. 418. See Monoculus.
- Flesh of the roe-buck, the hare, &c. See Roe-buck, Hare, &c.
- Floetz rocks, i. 73 n.

- Florakin, of the bustard genus, ii. 69 n.
 Floss, the external coating of the silk cone, ii. 454.
 Flounder, bearded, account of the, ii. 287 n.
 Fluidity, by what bodies possessed, i. 116.
 Flur-birds, how used by the bird-catcher, ii. 121.
 Fly. See Dragon-fly, and Cantharis.
 Fly-catcher, the red-eyed, its note, ii. 134 n.; the white-eyed, ib. n.
 Flying-fish, a soft-finned abdominal fish, ii. 290; pursued by the dorado, 298; in the air by the albatross, ib.
 Foal, instance of one sucking a goat, i. 306 n.
 Forster, the horrible, of some serpents, ii. 378.
 Fongwang, the Chinese, description of that bird, ii. 67.
 Fontenelle, his long life, i. 229.
 Food, necessity of, to man, i. 210; its influence on animals, 265.
 Foot, human, shape of the, i. 206.
 Forehead, human, its proportions, i. 202.
 Forests, found beneath the earth, i. 77 n.; 143, 144.
 Formica rufa, or wood ant, ii. 472 n. See Ant.
 Fossils, opinions concerning their formation, i. 73, 74; in what countries found, 74, 75; their varieties, 75; in what strata found, 76 n.; their difference from the productions of the present world, 77 n.; found in the stones of one of the pyramids of Egypt, 75; various classes of, 77 n.; zoophytes, 78 n.; shell-fish, birds, fishes, amphibia, 78 n.; herbivorous quadrupeds, 80 n.; elephants, an account of, 510, 511 n.; (see Mammoth); hyæna, account of the, 411, 412 n.; shells, in what condition found, ii. 324, 325; all belong to an extinct genus, 325 n.
 Fouine, name given by M. Buffon to the yellow-breasted martin, i. 417. See Martin.
 Fourmiiler, species of ant-eater, its characters, i. 530 n.
 Fox, its resemblance to the dog, i. 391; distinguished from it, and the wolf, ib.; its cunning, 392; in choosing a residence, ib.; in taking and conveying its prey, ib.; its food, ib.; chase of the, 392, 393; generation, 393; antipathy of animals to the, ib.; different kinds of the, 393, 394.
 Frigate, a bird of the cormorant kind, account of the, ii. 205 n.
 Frog, the, adapted to live on land or in water, ii. 347; distinguished from the toad, ib.; its appearance, ib.; its internal parts described, ib.; Raesal's plates of the, ib.; copulation of the, 348; impregnation, ib.; eggs from a female, ib.; their appearance, ib.; progress of the, to perfect frog, 349; manner of life, 350; season of enjoyment, ib.; age, ib.; food, ib.; manner of catching it, ib.; vivacity, ib.; one kept eight years in a glass, ib.; tenacious of life after the head off and other injuries, ib.; croaking described, ib.; season of, 351; adheres to the backs of fishes, ib.; story of one clinging to a pike and eating out its eyes, ib.; varieties, 351 n.; the green frog of France, described, ib.; used as barometers, 352 n.; eaten in Vienna, ib.; the bull-frog, its great size, ib.; the, described, ib.; abundance in Virginia, ib.; leap of the, ib.; eats young ducks, ib.; why called the bull-frog, ib.; its croaking described, ib.; the tree-frog, country of the, 353 n.; the, described, ib.; habitudes, ib.; tamed, ib.; absorption of water, ib.; eating of flies, ib.; contest between one and a serpent described, ib.; the fire-frog described, ib. n.; bones of a giant frog found at Stourton, ib.
 Frog, the fishing, described, ii. 280; how it takes its prey, ib.; doubts, ib.
 Froth-worm, the, account of, ii. 437; progress to the winged state, ib.
 Furs of northern quadrupeds, why so abundant and fine, i. 414.
- G**
- Gad-fly, injurious to the rein-deer in Lapland, i. 342; the ox, why so named, ii. 486 n.; described, ib.; the horse, described, 487 n.; found in the stomach of horses, ib.
 Gall insect, its residence, ii. 480; how introduced into the gall nut, ib.; how nourished, 481; its escape from the nut, ib.
 Galley-fish, appears like a bubble, ii. 281; described, ib.; whether it moves, ib.; size in America, ib.; colours and transparency, 282; causticity of the, ib.; poisonous nature of the, 300.
 Gally worm, the, how distinguished from the Scolopendra, ii. 421; appearance, ib.; how produced, ib.
 Game laws, arbitrary nature of the, ii. 275.
 Ganges, its original and course, i. 124; its inundations, 128 n.; venerated by the Indians, 124.
 Gannet, or soland goose, described, ii. 205; haunts of the, ib. 206; migrations, 206; quickness of sight, ib.; its eyelid, ib.; eggs and young, 207; profit from the sale of the, ib.
 Gar-fish, of the needle class, the, described, ii. 282 n.
 Garter-fish, the, distinguished, ii. 288.
 Gas, carbonic acid, found in mines, its composition, i. 90 n.; noxious nature, ib.; test of its presence, ib.; carburetted hydrogen or inflammable air, its composition, ib.; in what mines found, ib.; means used to prevent explosion, ib. and 91 n.; dreadful explosion of, at Felling, ib.; safety lamps, ib.
 Gasteropoda, Int. xlix.
 Gaston de Foix, a celebrated stag-hunter, i. 345 n.
 Gastric juice, Int. xxvii.
 Gaur, a species of bison, its size and habits, described, i. 296 n.
 Gavial, a species of alligator, ii. 308 n.; the great, ib.; the little, ib.
 Gayal, a kind of bison, described, i. 297 n.
 Gaze hound, the English, described, i. 400 n. and 383; how employed, ib.
 Gazelles, their distinguishing marks, i. 310; beauty, ib.; Buffon's varieties of the, 311, 312 n.; additional varieties, 313 and n.; their general properties, 314; method of hunting them, 314, 315.
 Gekko, a kind of salamander, ii. 369, 370 and n.; reported to be poisonous, 370; probably not so, ib.; account of the Lacerta gekko, ib. n.
 Generation of animals, Int. xv, xxix; i. 187; whence the fecundity, 187; Harvey's theory of, ib.; Leuwenhoeck's, ib.; Buffon's speculations concerning, ib.; objections to, 188; distinction of animals in respect of their, ib.; by cutting, ib.; from the egg, 189; traced, 190, 191; from embryo, 191; in man, 192; comparative perfection of, in different animals in respect of, 194.
 Genet, its beauty and perfume, i. 421; described and distinguished, ib.; its glands, ib.; tamed at Constantinople, ib.; scarcity of the, ib.; its character, ib.
 Genettes, Spanish, described, i. 272.
 Genus, what, Int. xi.
 Geological botany, i. 77 n.; geological theories, 72 n.
 Geology, science of, Int. viii.
 Gerboa genus, the, its approximation to the rat, i. 448 n.; to the kangaroo, ib.; the, described, ib.; its walk, ib.; species of the, ib.; abode, ib.; account of the gerboa, 533—535.
 Gerenda, a serpent of the East Indies, how regarded by the natives, ii. 396; that of Africa also worshipped, ib.
 Germ, what, Int. xv.
 Geysers, hot springs in Iceland, i. 119 n.
 Ghee, butter from the milk of the Indian buffalo, i. 300 n.
 Giants, existence of a race of, i. 76 n.; 246, 247.
 Gibbon, or long-armed ape, described, i. 478 and

- 493 n.; the ash-coloured, 493 n.; the little, ib.; the active, ib. See Ape.
- Gills, Int. xxviii.
- Gilthead, or ophidium, the fish, described, ii. 285.
- Giraffe, mistakes concerning the, i. 516 n.; account of several, 516, 517 n. See Camelopard.
- Glands, the secretory, Int. xxix.
- Glow-worm, difference of the male and female, ii. 478; the female described, ib.; its light, ib.; whence, and how emitted, ib.; for what purpose, ib. and n.; instances of the male being luminous, 479 n.
- Glutton, differences of opinion concerning the, i. 423; referred to the bear species, ib. n.; Klein's account of one from Siberia, 423; considered, ib.; where found, ib.; description of the, ib.; its manner of taking its prey, 423, 424; prefers putrid flesh, 424; pursues the beaver, ib.; its stratagems, ib.; its impudence, ib.; parturition, ib.; value of its skin, ib.
- Gluttony, its injuries, i. 212.
- Gnat, injurious to the rein-deer, i. 342; manner of laying her eggs in the water, ii. 484 and n.; change of form, 484; into a nymph, ib.; the fly, ib.; its trunk, ib.; strings, 485; method of using them, ib.; state during winter, ib.; propagates five times without copulation, ib.; their formidable nature in America, ib. and 485, 486 n.; great columns of the, in England, 486 n.
- Gneiss, i. 84 n.
- Gnu, somewhat betwixt the ox and horse, i. 324 n.; described, ib.; by Pringle, ib.; sometimes tamed, ib.; a species of the, described by Burchell, ib.
- Goat, characteristics and properties of the, i. 305; their qualities, ib.; acuteness of their senses, ib.; fitted for a life of liberty, ib.; its agility in ascending, 308 n.; natural attachment to man, proof of its, 305; instance of one suckling a foal, 306 n.; propagation of the, 306; qualities of its milk, ib.; its milk generally used in the Mediterranean countries, ib. n.; flesh, 306; pasture, ib.; varieties of the, 306, 307; Angora goat, described, 306; the Assyrian, 307 and n.; African, 307; the blue, ib.; the Juda, ib.; diversities and analogies of the different kinds, ib. 308; its descent, ib. n.; the ibex and chamois, 308 and 321 n.; African wild, 313.
- Gobius. See Gudgeon.
- Godwin Sands, i. 142.
- Godwits, habitudes of, ii. 191 n.; timidity, ib.; how taken, ib.
- Gold, not corroded by the atmosphere, i. 151.
- Goldfinch, season of singing, ii. 147 n.; nest and young, ib.; performances of the, ib.; activity, ib.; mules from the, and canary, &c. ib.; assemblies, 148 n.; food, ib.; varieties of species described, ib.; cropping of the bill of the, when necessary, and how to be performed, 149 n.; mules from the, good singers, 150 n.; food, ib.; whether fertile, ib.; American, its note, 134 n.
- Goondah, or male elephant, how hunted, i. 506 n.
- Goose kind, characteristics of the, ii. 218; bill, ib.; food, 219; fecundity, ib.; flesh, ib.; domestication, ib.
- Goose, characteristics of the wild, ii. 223; where it breeds, ib.; flight described, 224 n.; acuteness of the senses of the, ib.; its vigilance, 225 n.; fecundity of the tame, 223; its valiant defence of its young, ib.; flesh of the young, ib.; goose feathers, ib.; commerce in, 224; anecdotes of the, 224—226 n.; story by Motherwell of the loyal goose of Paisley, 224 n.; partiality of one to bay colts, 225 n.; history of 'Old Tom,' ib.; varieties of the bird, the barnacle, ib.; the brent, ib.; the snow, account of, 226 n.; its stupidity, and how taken, ib.; the swan-goose described, 227 n.; an account of the Canadian, ib.; its passage to the North, ib.; profit of the, to the natives, ib.; female and incubation, ib.; the spurwinged, an account of the, ib.
- Goose, soland, ii. 205. See Gannet.
- Gooseander, the largest of the auk kind, an account of the, ii. 217 and n.
- Gordius aquaticus, Int. xv.
- Goshawk, account of the, ii. 45 n.; how esteemed in falconry, ib.
- Gossamer, a kind of spider, described, ii. 410 n.; its habits, 411 n.; why called in Germany the flying-summer, ib.
- Gottenburgh, in Sweden, cataract near, i. 126.
- Gouan, Mr., his classification of spinous fishes, ii. 284—292.
- Goura, or crowned pigeon, ii. 111 n.
- Graaf, his investigation of the growth of animals in the womb, i. 191.
- Grampus, how distinguished, ii. 262; its agility, ib.
- Granite, i. 84 n.
- Grasshopper, its class, ii. 429; distinguished from the ancient cicada or treehopper, ib.; its instrument of sound, ib.; the little grasshopper described, ib.; its note, ib.; opinions concerning the causes of its sound, ib. 430; impregnation, 430; dies during winter, ib.; the young, 431; their wings, ib.; perfection of the insect, ib.; habitudes, ib. and 432; Keats' and Hunt's sonnets to the, 429 n.
- Gravitation, progress of the discovery of, i. 61 n.
- Grayling, the fish noticed, ii. 290 n.
- Grebe, analogies of the, bird, to the web-footed and crane class, ii. 194; account of the bird, ib.; use of its skin, ib.; a tribe of birds characterized, 218 n.
- Greenlanders, &c., described, i. 232; their pride, 233; hardihood, ib.; Greenland whale-fishery, account of the, ii. 256 n.
- Greyhound, the Irish, its extraordinary size, i. 399 n. 384, 385; Scotch Highland, or wolf dog, described, 400 n.; history of that possessed by Sir Walter Scott, ib.; described, 401 n. and 383; its properties recounted by Wyken de Worde, 401 n.; their estimation at different times, ib.; Scottish, Italian, and Turkish, ib.
- Griffard or martial eagle, account of the, ii. 31 n.
- Grosbeak, the pine, its note, and that of the cardinal, ii. 133 n.; characters of the family, 150 n.
- Grouse, its varieties, ii. 69; where numerous, ib. n.; refuge in Scotland, ib.; cock of the wood, 69, 70 (see Wood cock); varieties, the ruffed grouse described, 73 n.; found in the new continent, ib.; gaiety and thumping, ib.; the pinnated, described by Wilson, ib.; dislikes water, ib.; its remarkable bags and sound, 74 n.; the black, described, 71 n.; contests of the males, ib.; the red, described, ib.; the ruffed, 73 n.; the pinnated, ib.; rock, 74 n.; sand, ib.; heterochitous, ib.; hazel, pintado, and willow, ib.
- Growth of the human body traced, i. 196; of the mind, 197, 198.
- Grub, how discovered and eaten by the crow, ii. 87 n.; of the may-bug, how deposited, 477 n.; transmutations, ib.; injuries to fields, ib.; how prevented, ib.; the wire-worm, ib. n.; its injuries, ib.; Sir Joseph Banks' remedy for the, ib.
- Guan, the, a gallinaceous bird, described, ii. 64 n.; domesticated in South America, ib.; its manners, ib.
- Guanaco, a kind of llama, i. 561.
- Guanches, their method of embalming, i. 249.
- Guariba, a Brazilian monkey, i. 486.
- Gudgeon, the, noticed, ii. 285; another species common on the coast of this island, ib. n.
- Guba, a kind of gazelle, i. 313.
- Guillemot, of the auk tribe of birds, an account of the, ii. 218 n.; the black, described, ib.; its haunts and habits, ib.; incubation, 215.
- Guinea Pig, its country, i. 439; the animal described, ib.; its helplessness, ib.; domesticated, ib.; habits

- and food in that state, *ib.*; cleanliness, *ib.*; manner of sleeping, 440; salacity and generation of the, *ib.*; contentions of the, *ib.*; timidity, *ib.*; is tamed, *ib.*; grunt of the, *ib.*; flesh of the, *ib.*
- Gulls, characteristics of the class, *ii.* 198; of the smaller kind, 207; flight of the, *ib.*; why called the vulture of the sea, 211 *n.*; found in all latitudes, *ib.*; haunts, 207; sublimity of the scenes in which they often appear, 208; contests while breeding, *ib.*; nests and eggs, *ib.*; the birds how taken, *ib.* 209; varieties, 207 and 211 *n.*; the skua-gull, 211 *n.*; the black-headed, 212 *n.*
- Gurnard, properties of the fish, *ii.* 285.
- Gymnotus, or electric eel, an account of the, *ii.* 286 and *n.*
- H**
- Haddock, the, described, *ii.* 287 *n.*; size, *ib.*; when in season, *ib.*; periodical shoal of the, 295.
- Hæmorrhoids, a viper, why so called, *ii.* 394.
- Hail, how produced, *i.* 172; storm in Hertfordshire, 1697, description of the, *ib.*; of the one in France 1510, *ib.*
- Hair of the human head contributes to beauty, *i.* 202; what falls soonest, *ib.*; its diversities, *ib.*; structure, *ib.*; colour, *ib.*; in different nations, *ib.*; its relation to temperament, *ib.*; practices of different nations with respect to, 204; various colours of the human, 241 *n.*
- Haje, the asp of the ancients, *ii.* 394 *n.*; manner of attack, *ib.*; sculptured on temples in Egypt, *ib.*; poisonous bite, *ib.*; remedies, *ib.*
- Halcyon, the king-fisher, *ii.* 234; fables and poems concerning the, *ib.*; Ovid's account of its metamorphosis, 235 *n.*; Aristotle's account of it, *ib.*; Pliny's account of its vocal powers, *ib.*; Montaigne's and Plutarch's notion that its nest made of fish bones, *ib.*; modern fancies concerning the power of the bird when dead, 237 *n.*; superstitions of the Tartars and Ostiaks, *ib.*; graphic description of the, by Macgillivray, 237, 238 *n.*
- Halley's theory to explain the constant east winds near the tropics, *i.* 160; to explain the monsoons, 169 *n.*
- Halo round the moon, *i.* 175.
- Hamster, name given by Buffon to the German rat, *i.* 447; the Canadian, 447 *n.*; the anomalous where found, *ib.*; described, *ib.*
- Hand, the connexion between the hand and intellect, *i.* 226.
- Hare kind, swiftness of the, *i.* 426; characteristics of the, *ib.*; method of determining, *ib.*; their food, *ib.*; swiftness, *ib.*; motion of their lips, *ib.*; prolific propagation, *ib.*
- Hare, its adaptation for flight and swiftness, *i.* 427; its numerous enemies, *ib.*; fertility, *ib.*; extraordinary arrangement for this, *ib.*; treatment of young, *ib.*; food, *ib.*; sleep, *ib.*; pairing, *ib.*; motion in flight, *ib.*; age, 428; voice, *ib.*; instincts for self-preservation, *ib.*; shifts to escape, *ib.*; stratagems of an old hare to escape from a hound, *ib.*; from a grey-hound, *ib.*; from a harrier, *ib.*; the mountain and measled hares, forms of the, 428; habits of the, 429; influence of climate on the, *ib.*; white hares, *ib.*; their furs, *ib.*; effect of heat on the, *ib.*; flesh of the, by what nations not eaten, *ib.*; by what esteemed, *ib.*; decrease of numbers, *ib.*
- Harfang, great Hudson's Bay owl, *ii.* 50.
- Harrier, the, described, *i.* 382, 406 *n.* and 383.
- Harrier, the, a kind of falcon, *ii.* 47 *n.*; the marsh, *ib.*; the hen, *ib.*; the ash-coloured, *ib.*
- Hart, *i.* 327; boldness of one at Taymouth-castle, 330 *n.* See Stag.
- Hartebeest, a kind of antelope, *i.* 324 *n.*; described by Pringle, *ib.*; its enemies, *ib.*
- Harvey's theory of circulation, *Int.* ix.; of generation, *i.* 187.
- Hatfield chase, in Yorkshire, reduced to cultivation, *i.* 144.
- Hawk, the, and hawking, *ii.* 40 (see Falcon, Falconry); the sparrow-hawk, 41 *n.*; hawking in Persia, 46 *n.*
- Head, state of, in man at birth, *i.* 196; the remarkable, of the cassowary, *ii.* 20.
- Hearing, *i.* 220; errors to which liable, *ib.*; its object sound, *ib.*; defects of, 222; inequality of, with different ears, *ib.*; necessity of, to man, *ib.*; how the sense of, supplied in birds, *ii.* 5.
- Heat of atmosphere, variation of, in descending mines, *i.* 87; its effects on water, 114; its measure, 119 *n.*; produces a noxious quality in the air, 153; subterranean, 89 *n.*; Cordier's investigation of, *ib.*; beneficial effects of, 103.
- Hecla, volcano of, *i.* 93 and 96 *n.*
- Hedgehog, characteristics of the species, *i.* 452; prickles of the, *ib.*; harmlessness, *ib.*; varieties, *ib.*; method of defence, *ib.* 453; habits and food, 453; is uninjured by animal poisons, *ib.* *n.*; habits in a tame state, described by Buffon, 453; propagation, *ib.*; blood, *ib.*; sea, discriminated, *ii.* 281.
- Helmo. See Fires of St. Helmo.
- Hen, hatching of the, and number of its eggs, *ii.* 56; affection for her chickens, 57.
- Hen, Guinea or Barbary, *ii.* 67. See Pintado.
- Hen, water, account of the, *ii.* 193, 194.
- Henry I., cause of his death, *ii.* 277 *n.*
- Henry VIII., his edicts with respect to horses, *i.* 279 *n.*
- Hermaphrodites, all snails such, *ii.* 328; sea snails peculiar, 330; bivalve shell-fish, 333.
- Hermetical sealing, how performed, *i.* 113 *n.*
- Hermits, abstinence and long life of several, *i.* 212.
- Herodotus, his description of the Egyptian method of embalming, *i.* 248.
- Heron, the, distinguished from the crane and stork, *ii.* 174, 175; characteristics of the species, 175 *n.*; the common, described, 177 *n.*; passage of the, 178 *n.*; nests and young, *ib.* 176; food, 178 *n.*; how taken, *ib.* 176; untameableness of the old, 179 *n.*; varieties, 175; the night heron, account of the, 179 *n.*; the common purple, *ib.*; heron hawking, 179 *n.* 175; prey of the, 175; flesh of the, esteemed in France, 177; heronries, *ib.* and 178 *n.*; longevity of the, 177; contests of the, with rooks for a heronry, 81 *n.*
- Herring, the, characterized, *ii.* 290; where chiefly found, 295; why it migrates, *ib.*; destructive enemies of the, *ib.*; progress of the phalanx of the, *ib.*; arrival on our coasts, *ib.*; its columns, *ib.*; detachments, *ib.*; whether any return, 296; frequents a favourite bank for many years and then seeks another, *ib.* and 303 *n.*; avoids shoals, *ib.*; instance of many wrecked on the east end of Fife, 303 *n.*; delicate fish, *ib.*; account of the stranding of an immense number at the harbour of Crail, *ib.*; at the lochs of Scotland, *ib.*; the question of the migration of, considered, *ib.*; spawn, *ib.*; fry, 304 *n.*; whether they spawn every year, *ib.*
- Hiera, a new island, *i.* 103.
- Hind, female of the stag, *i.* 327; her cry, 329; courage and sagacity, 330.
- Hippocampus, a fish, account of the, *ii.* 280, 281.
- Hippopotamus, description of the, *i.* 514; haunts, *ib.*; manner of life and prey, *ib.*; strength, 515; manner of escape, *ib.*; flesh of the, *ib.*; propagation, *ib.*; where found, *ib.*
- Hoanbo, river in China, *i.* 124; receives 35 rivers, 125.
- Hoar-frost, what, *i.* 172.
- Hobby, a kind of hawk, migratory, its haunts, nest, prey, *ii.* 44.
- Hog kind, animals of the, their distinguishing proper-

- ties, i. 348 and n.; general properties of the, re-counted, 356; its food in a wild state, 349; when domesticated, ib.; its sluggishness and insensibility, 350; some taught and broken, ib. n.; converted into beasts of burden, ib.; its drowsiness and gluttony, 350; venery, ib.; sympathy, ib.; diseases, ib.; their extraordinary fecundity calculated, 350 n.; a useful food, 351 n.; its esteem among ancient epicures, ib.; how the flesh of the, unwholesome in eastern countries, ib.; prohibitions to eat, ib.; East India breed, 351; single-hoofed, ib. and 352 n.; Guinea, 351; English, 352 n.; that of Jutland, ib.; Zealand, Poland, &c., ib.; France, Turkey, &c., ib.
- Holland, gained from the sea, i. 142.
- Honey, whence extracted, ii. 458. See Bee, white and yellow, 461.
- Hooded serpent, account of the, ii. 394 and n. See Cobra.
- Hooke, Dr., his general notion of gravitation in 1666, i. 61 n.
- Hooper, the wild swan, ii. 221 n.; why so called, 220.
- Hoopes, their analogy to wood-peckers, ii. 101 n.
- Hornet, the, discriminated, ii. 467 n.; where found, 468 n.; habitudes, ib. n.; nest, ib.; eggs, ib.; different classes of the, ib.
- Horn-fish, name of the gar-fish, ii. 282 n.
- Horns of the cow kind, i. 290 n.; diversities in the, 295 n.
- Horse, its relative station, i. 268; description of by Linnaeus, ib. n.; its beauty, 268; Cuvierian arrangement of the, Int. xi; other authors' arrangements, 268 n.; where found in native state, 268; various species of the, 268 n.; fossil, ib.; habits when in droves, 269; early period of its domestication proved, 277 n.; its original country, 269 and 277 n.; state of the, among some ancient nations, 277 n.; its gradual subjection proved, ib.; American, 269; Tartar wild horses, ib.; African, 270; Arabian, ib.; Arabian tamed horse, 270, 271; diffusion of the Arabian breed of the, 271, 272; Barbary horse, 271; Persian, 272 and n.; Italian, Danish, &c., 273; French, described, ib. and n.; Norman, 273 n.; tame of America, 273; of the Archipelago, 274; of Media, ib.; India, ib.; breed of, how kept up, ib. n.; one presented to our Queen, described, 274; of Guinea, ib.; of China, ib.; Tartars live with their, ib.; Grecian, 275; English, ib.; swiftness of the, ib.; English hunting, 276; number of, in England at different times, ib.; earliest record of the horse in Britain, 277 n.; ancient history of the English, 278 n.; its ancient value, ib.; provisions against frauds, ib.; history of the improvements on the English, 278, 279 n.; when first used for the plough in England, 278 n.; Crusaders, ib.; regulations respecting the price of the, ib.; description of a perfect, 275; one taught rope-walking, 508 n.
- Hottentots, their encounters with the lion, i. 361, 362, and 363, 364 n.
- Hound, the old English, described, i. 405 n.; by Shakspeare, ib.
- Howell, the good, values, and makes regulations against fraud in horses, i. 278 n.; his laws about the price of cats, 359.
- Howlet, a kind of owl, ii. 50.
- Hudson, name given by Buffon to the Urson, i. 456.
- Humber, an island formed at the mouth of the, i. 105.
- Humble bee, an account of the, ii. 462; its cells, ib.; females, ib.; method of putting the colony into motion, ib.
- Humming bird, beauty of the colours of the, ii. 161; varieties, ib.; the, described, ib.; visits flowers, whether it extracts honey from them, ib. and n.; account of its nest, 162; of the nest in America, ib.; disappears in the winter, in cold climates, ib.; note of the, ib.; plumage, ib.; species of the, described, 163 n.; the tufted-necked, the azure-blue, the harlequin, the ruby-crested, Gould's, the gigantic, the least, the white-striped, the tri-coloured, Rivoli's, the violet-crowned, Stokes', the northern, the crested, the purple, Wagler's, the horned, the half-tailed, the azure-crowned, the blue-fronted, 163 n.; Temminck's, the sapphire and emerald, Clemence's, the topaz-throated, the violet-eared, 164 n.
- Hunger, common to all animals, i. 210; description of a person enduring the extremities of, 211; proximate cause of, 211 n.; its uses, 211; how caused, ib.; few die of absolute, ib. 212; many of the diseases it induces, ib.; how long endurable, ib.; how palliated, ib.
- Hunt, L., his sonnet to the grasshopper and cricket, ii. 430 n.
- Hunter spider of Rome, its habits described, ii. 409 n.
- Hunting, American horses, how employed in, i. 273; of the chamois, described, 309, 310 and n.; of the elephant, &c. See Elephant, &c.
- Hurricane, description of the, i. 164, 165.
- Huso sturgeon, account of the, ii. 279; its isinglass, ib.
- Hutton, his theory of the earth, i. 72 n.
- Hyæna, distinguished from the wolf, i. 396; its fierceness, ib.; cry or moan, ib.; a solitary animal, 397; dispositions of the, ib.; fables concerning the, ib.; two species of the, ib. n.; the striped, described, 409 n.; where found, ib.; popular notions concerning the, ib.; reflections on these, ib.; the spotted, ib.; where found, ib.; in South Africa, a carrion eater, 410 n.; depredations of the, ib.; instances of domestication, 411 n.; intractability of the, ib.; stories of the, 410, 411 n.; fossil, where found, 411 n.; conjectures concerning the, ib.; state in which the bones found, ib.; size of the, 412 n.
- Hydra, or fresh-water polypus, its reproduction, ii. 495 n.; described, ib.; its mobility, 496 n.; its food and voracity, ib.
- Hydrostatics — See Water — paradoxes in, i. 116; metals, how weighed hydrostatically, 117; laws of hydrostatics, ib.

I

- Ibex, the, supposed by Buffon to be the source of the goat, i. 308; their resemblance, ib.; the, described, 321 n.; its haunts, ib.; the Abyssinian, described, ib.; Caucasian, ib.; agagrus, ib.
- Ibis, venerated by the Egyptians, ii. 169; what bird it was, different opinions, ib. and 171 n.; Bruce's opinion, 171 n.; confirmed by Cuvier, ib.; the animal described, ib.; why venerated by the Egyptians, ib.; the black species, 172 n.; flight of the animal, ib.; how taken, ib.; food of the, ib.; the scarlet, of America, account of the, ib.; of one kept by M. de la Borde, ib.
- Ice, i. 114; its elasticity, 115; mountains and sheets of, at the polar regions, 134; how formed, ib.; of what composed, ib.; mountain ice, description of, ib. 135; Crantz's account of the formation of, 135.
- Ichneumon, the, where found, i. 418, 419; its size, shape, and colour, 418; agility, and courage, 419; its prey, ib.; destroys the crocodile's eggs, ib.; fables concerning, ib.; its habitudes, ib.; physiognomy, ib.; glands, ib.; account of one sent from Ceylon, ib.; veneration of the Egyptians for the, ib.
- Ichneumon fly, the, inserts its eggs into the grasshopper, ii. 431 n.; into the caterpillar, 451; its formidable nature, 468; whence the name, ib.; the, described, ib.; its weapon of offence, &c., ib.; manner of depositing its eggs, ib.; progress to the fly state, ib.; its uses, 469.

- Ichthyosaurus*, i. 78 n.
Ignis Fatuus, what it is, i. 173 n.; description of several appearances of the, ib.
Iguana, size and description of the, ii. 373; varieties, 375 n.; the common American, described, ib.; the slate-coloured, ib.; the horned, of St. Domingo, ib.; the fasciata, ib. n.; excellence of the flesh of the *Iguana*, ib. and 373; how taken and killed by the Americans, 373.
 Illusions, meteoric, i. 175, 176.
 Incubation of birds, account of the, ii. 8.
 Indians, American, how they palliate hunger, i. 212; their method of charming serpents, described by Philostratus, ii. 384.
 Indigo bird, habitudes and note of the, ii. 134 n.
 Indus, tides at the mouth of the, i. 138.
 Infancy of man, history of the, i. 195; sensations during, ib.; vivacity of negroes during, ib.; infants when newly born, their appearance, ib.; their voracity, 196; endurance of hunger, ib.; their life precarious, ib.; their growth, ib. 197; progress of their understanding, 197, 198.
 Inflammation, Int. xxiii.
 Infusoria, Int. l.
 Insecta, Int. l.
 Insects, few traces of, in the fossil state, i. 78 n.; Swammerdam's notions of their dignity, ii. 401; their real imperfection in formation, ib.; instincts, ib.; difference of irritability between them and that of the higher animals, ib. n.; utility, 402; their numbers, ib.; unimstructible, ib.; definition of insects, ib.; numerous distinctions among, ib.; similitudes among, 403; classification of, 404; insects whence named, 404 n.; manner of breathing, ib.; mouth, where placed, ib.; feeling antennæ, ib.; without heart or arteries, ib.; eggs of the, ib.; metamorphosis to larvæ, ib.; to the chrysalis state, ib.; to the perfect state, ib.; construction, multiplying and diminishing power of their eyes, 404, 405 n.; their wings, 405 n.; feet, ib.; tongue, mouth and feelers, ib.; classification of, 405; those which remain in the reptile state, 406; of the second order, or those which soon assume wings after production, 425; of the third, or caterpillar class, 440; of the fourth order, 445; varieties, ib.
 Instinct, Int. xxxiv.; discovered in the incubation of birds, ii. 9.
 Inundation of rivers, i. 128 n.; of the Nile, 129 n.; different effects of, 126; diurnal, ib.; of the sea, 142.
 Irritants, Int. xxii.
 Isatis, the, compared with the dog and fox, i. 396; climates in which found, ib.; change of colour with the year, ib.
 Isinglass, from what kind of sturgeon furnished, ii. 278, 279; its uses, 279; how prepared, ib.; commerce in, ib.; by what fishes yielded, ib. n.
 Islands, new, i. 103; one appears and disappears near Iceland, 104 n.; coral islands, ib.; islands formed by rivers, 104; islands which have disappeared, 105.
 Isthmus supposed to have been between Britain and France, i. 142 n.
 Ivory, the commerce in, an account of the, i. 509, 510 n.; fossil, 510 n.
- J
- Jabiru, a large bird of the crane kind, ii. 173; characters of the class, ib. and n.; the Jabiru guacu, discriminated, 173; the American and Negro of the Hollanders, its characteristics, 173 n.; habitudes, ib.; that in Guiana, 174 n.
 Jackal, a species widely diffused, i. 394; its habits, ib.; packs of the, ib.; manner of hunting, 395 and n.; followed by beasts of prey, 395; its antipathy to the dog, ib.; the cry of the jackal described, ib. n.; why not tamed, ib.
 Jackdaw, account of the, ii. 81.
 Jacu, name of the guan in Brazil, derived from its note, ii. 64 n.
 Jaculus of Jamaica, a swift serpent, ii. 394.
 Jaguar of America, described, i. 373 n.; black variety, ib.; how hunted, ib.; dangerous to the traveller, ib.; distinguished from the panther, 374, 375.
 Jamaica, earthquake in, 1692, i. 99; meteoric phenomena there, 174; account of the land crabs of, ii. 313 n.
 James I., anecdote concerning, showing the scarcity of silk in his time, ii. 452 n.
 Japan, volcanoes in, i. 94, and 95 n.; Japanese tribe, described, 234.
 Jaw, human, motion of the upper and under, i. 203; position of the under in different ages and nations, ib.
 Jay, description of the, ii. 90 and 92 n.; its residence, 92 n.; the Florida jay noticed, ib.; Steller's, ib.; the Canadian, ib.; the red-billed, described, ib.; the blue, ib.; account of its habits, nest and war-fares, by Wilson, 92, 93 n.; its mimicry, 93 n.
 Jeck, Mademoiselle de, name of a remarkable elephant exhibited, i. 507 n.
 Jeffrey, little, a dwarf, i. 245.
 Jenisca, river in Tartary, i. 124.
 Jenkins, his longevity, i. 229.
 Jews, their horses, i. 277 n.; their asses, 283 n.; considered the ass unclean, ib.; eat it in famine, ib.
 Jerboa. See Gerboa.
 Jevraska, the marmout in Siberia, i. 437.
 John, King, an improver of the breed of horses, i. 278, 279 n.
 Jucatan, a peninsula, left by the sea, i. 142.
 Judgment, Int. xxxii.
 Jugular fish, what, ii. 284; prickly-finned, 285; soft-finned, 287.
 Julius terrestris, Int. xxv.
- K
- Kabassou, kind of armadillo, i. 400.
 Kamsin, a destructive wind in Egypt, i. 163 n.
 Kangaroo, discovered by Sir Joseph Banks, i. 534; that stuffed and brought home by him, described, 535; errors concerning the, 534 n.; singular use of its tail, ib.; the flesh of the, 535 n.; domestication, ib.
 Keats, his sonnet to the grasshopper and cricket, ii. 429 n.
 Kean, the tragedian, his tame puma, or American lion, i. 374 n.
 Kermes, the insect, where produced, ii. 479; the female described, ib.; the male, 480; how prepared, ib.
 Kestrel, kind of hawk, account of the, ii. 44 n.
 Kevel, a kind of gazelle, i. 311.
 Kilbagre, a name of the cayman, ii. 369 n.
 Kilsyth, lady, and her son, their bodies found embalmed at Kilsyth, i. 252 n.
 King-fisher, its appetites and beauty, ii. 234; the bird described, ib.; its rapacity and activity in seizing its prey, ib.; fables and poems with respect to its power of allaying a storm, 234; Ovid's story, 236 n.; (see Halcyon); Wilson's account of the belted, ib.; nest of the bird, described, 235; account of its nest by Belon and Gesner, 236, 237 n.; whether its nest made of fish bones, ib.; account of the habits of the, 237 n.; its seclusion, ib.; fancies of several with regard to the animal when dead turning its beak to the wind, ib.; superstition of the Tartars with respect to the, ib.; Macgillivray's account of the, 237, 238 n.; female and young, 235.
 Kirauca, crater of, described, i. 96 n.
 Kircher, Athanasius, his credulity with respect to the stuffed halcyon, ii. 237 n.

- Kirkdale, cave of, with its fossil contents described, i. 411 n.
- Kite, the, a kind of hawk, ii. 42; where found, 43 n.; its prey and depredations, ib.; nest and eggs, ib.
- Kitten, its playfulness, i. 357; laws of Howel about the price of a, 359.
- Klein, his method of classifying animals, i. 254.
- Kob, and Koba, two kinds of gazelles, i. 311.
- Koomkee, or female elephant, how employed in hunting the male, i. 506.
- L**
- Labiate*, Int. xliii.
- Labrus*, a prickly-finned fish, notice of the, ii. 285.
- Labyrinth of Crete, i. 84.
- Lacteal*, Int. xxviii.
- Lammer-geyer, a kind of vulture, confounded by Buffon with the condor, ii. 35 n.
- Lakes, their saltness and freshness accounted for, i. 133.
- Lampern, account of the, ii. 276 n.
- Lamprey, different species of the, ii. 276 n.; the lesser described, ib.; that at present served up among the Italians, 276; account of those known among us, ib.; the fish described, ib.; its manner of swimming, ib.; its adhesive quality, 277; mucus, ib.; spawn, ib.; short life, ib.; how taken, ib.; who died of a surfeit of, ib. n.; esteemed among the ancients, 277.
- Lamprey-pie, one presented at Christmas by the city of Gloucester to the King, ii. 277.
- Land-breezes, i. 162.
- Lands, new, formed by the sea, i. 142.
- Lantern-fly, of Peru, ii. 436 n.; its phosphorescent light, ib.
- Lapland, the country of the rein-deer, described, i. 341; rein-deer, chief riches of the natives of, ib.; their method of defending the rein-deer from its enemies, 342; their method of spending the winter with the rein-deer, ib.; their comfortable life, 343; their comparative wealth, 344 n.; their milking of the rein-deer described, ib.; their profit from the misfortunes of the squirrel, 433; draw omens from the contests of the leming, 499; the people described, 232, 233.
- Lapwing, described, ii. 193 n.; where found in winter, ib.; food and habitudes of the, ib.; female and young, ib.
- Lark, song of the, what it depends on for its agreeable nature, ii. 136; its nest, 137; female, ib.; habits in winter, ib.; how distinguishable, 136; varieties; the crested described, 138 n.; abode and habitudes, ib.; the wood, described, ib.; where found, ib.; song of the, ib.; distinctive qualities, ib.; the short-toed, account of the, ib.; the clapper of Africa, ib.; the red-backed, 139 n.; the Alpine, the calandre, ib.; sirli, ib.; double-crested, ib.; field, or pipit, 143 n.; shore, note of the, 134 n.; sea, impropriety of the name, 192 n.; account of the bird, ib.
- Larvæ, the state of insects when passed from the egg, ii. 404 n.; the, of the Italian locust, their motion described by Pallas, 434 n.
- Laughter, how produced, i. 203.
- Launce, a soft-finned fish, ii. 287.
- Lavandieres, why wagtails so called by the French, ii. 142 n.
- Lawrence, St., course of the, i. 125; cataract of the, 127.
- Leaf-cutting bees, account of, ii. 461. See Bee.
- Leech, the, its class, ii. 422; use, ib.; the useless varieties, ib.; that used in medicine, ib.; its description, ib.; its internal construction, ib.; breathes through the mouth, 423; viviparous, ib.; used as a barometer, ib. n.; size in America, ib.; remarkable ones of Ceylon, 424 n.; greediness of horse-leeches, ib.; in Chili they exist in woods, ib.; how leeches should be applied, 423; gorged with blood to increase their weight, 424 n.
- Legs of quadrupeds, i. 262.
- Leguat, Francois, his account of the Dodo quoted, ii. 23 n.
- Leming, boldness and numbers of the, i. 448; propagation, ib.; manner of its migration in troops, ib. 449; destroy one another, ib.; their contests considered ominous by the Laplanders, ib.; propagation, ib.; flesh, ib.
- Lemur, the slow-paced, size, i. 495 n.; description, ib.; habits, ib.; fur, ib.; irritability, ib.; manner of feeding, ib.; country, ib.; the red, described, ib.
- Leopard, distinguished from the Panther, i. 374; that of Senegal described, ib.; maned hunting, approaches the dog, 375 n.; described, 377 n. See Cheetah; habits of the, 377.
- Lepadogaster, the fish, described, ii. 287.
- Lerot, a kind of dormouse, i. 445.
- Letters, what most easily pronounced by infants, i. 197.
- Leuwenhoeck's theory of generation, i. 187.
- Leymmer, a mongrel dog, described, i. 406 n. 383.
- Lias formation, i. 83 n.
- Libella, or dragon-fly, ii. 425. See Dragon-Fly.
- Liboya, a great serpent of Brazil, ii. 396; size of the, ib.; habits of the, 397.
- Lidme, a kind of gazelle, i. 312.
- Life, defined, Int. xliii. xxxviii.; conditions of, ib.; destroyed by withdrawing the air, i. 151; duration of, in an animal, how it may be determined, 229; prolonged by management, ib.; by what affected, 230; love of, in man, ib.; its cessation, 231; difference between animal and vegetable, ii. 487 and n.
- Ligaments, Int. xxvii.
- Light, its refrangibility, i. 157 n. See Vision.
- Lightning, how produced, i. 172.
- Limax, Int. xvi.
- Limpets, eaten in the Isle of Sky, ii. 339 n.
- Linnaeus, his classification of animals, i. 255; of fishes, ii. 284; his discovery of a method of causing the fresh water muscle to produce pearls at pleasure, 341 n.; how rewarded, ib.
- Linnet, the red and gray, the same bird at different seasons, ii. 148 n.; analogy to the canary, ib.; docility and attachment of the, ib.; modes of instruction, ib.; longevity in captivity, ib.; nest, ib.
- Lion, the, affected by climate, i. 361; of Africa and mount Atlas, ib.; their number diminished, ib.; how attacked by the Hottentots, 361; boldness of the African, 362; feebleness of the Indian, ib.; disposition of the, ib.; outward form, hair, muscles, &c. ib.; mane, 363; imperfection of sight and smell, ib.; habits of the African lion, ib. n.; Burchell's account of an encounter with the, 363, 364 n.; method of seizing his prey, 364; roar and action, when furious, ib.; why he lashes his sides when enraged, ib. n.; combat with the wild boar, 365; action when pursued, ib.; its desperate sallies, ib.; their combats for the female, ib.; the lioness, ib.; their age, 366; attachment of the female to the young, ib.; lions in confinement, ib. n.; confined in Persia, ib.; their different dispositions under confinement, ib.; fight with dogs at Warwick, ib.; instances of attachment to the human race, ib.; Bildulgerid, 366; none in America, ib.; Aristophanes' advice with respect to trusting the lion, 367; singular fight with a lion and two tigers in the tower, 367, 368 n.
- Lion-ant, the dragon-fly in the insect state, ii. 427; described, ib.; its form, ib.; method of taking its prey, ib. 428; manner of removing obstructions in its pit, 427 n.; change of habits, 428; its ball of thread, ib.; its escape as a fly, ib.

- Lion, sea, described by Anson, a kind of seal, i. 471.
 Lips, human, their expression, i. 202.
 Lisbon, earthquake at, i. 99 and 102 n.
 Lisle, De, his thermometer, i. 119 n.
 Littorales, shell-fish cast on shore, ii. 324.
 Lizard kind, opinions of naturalists concerning their rank in nature, ii. 361; differences among the tribe of the, ib.; colours, ib.; figure various, ib.; distinction from the manner of bringing forth the young, 362; three classes thus formed, ib.; distinguishing properties of the, ib.
 Lizards, beauty of some, ii. 373; the variegated, its size and description, 376 n.; colour, ib.; the green, where found, ib.; the, described, ib.; harmless, but disagreeable from the colour, ib.; the green, of Carolina, ib.; its colour affected by the weather, ib.; the nimble, an account of, ib.; the flying, of Java, 374; the Chalcidian, the step between the lizard and the serpent, 375; described, ib.; viviparous, ib.; perhaps dangerous, ib.; scaly, i. 456. See Pangolin.
 Llama, the camel of the new world, i. 520; distinctions between the two animals traced, 521, 522 n.; the species of the, 522 n.; their locality in South America, ib.; discovered by the Spaniards there, in what state, ib.; colours of the, 520; habitation, ib.; size and description, 521; usefulness of the, to the American Indians, ib.; description of the, in the wild state, ib.
 Loach, the, described, ii. 291.
 Lobster, resemblance of the, to the crab, ii. 306; description of the, ib.; the ovary and young, ib.; its food, ib.; changes the shell once a-year, 307; how performed, ib.; state after change, ib.; eats its own stomach and shell, ib. and 308 n.; concretion, within its body, 307; sudden increase of size, 308; contests, ib.; the loss of a claw repaired, ib.; nimbleness in leaping, ib. n.; lose the claws at thunder-claps or cannon-shot, ib.; the extraordinary properties of the animal enumerated, 309; varieties, ib. and n.; the Norway described, ib. n.; how taken, ib.
 Locust, its description, ii. 432; ravages of swarms of the, ib.; Scripture comparisons, ib.; appearance of a swarm, ib.; devastation wrought by the, ib.; in Russia, 1690, ib. and 433; in 1724, witnessed by Dr. Shaw, 433; a flight of, witnessed by Mr. Darwin, 434 n.; their invasion of Southern Africa, ib.; the larvae, ib.; causes of migration, 433; where eaten, 434; the, of Tonquin, ib.; eaten by the Jews, ib.; the great West Indian, described, 433; transformation of the, 433 n.
 Loggerhead turtles described, ii. 317; where found, ib. n.; boldness and strength, ib.
 Loir, a kind of dormouse, i. 445.
 London, number who die in, of destitution, i. 212.
 Longevity, causes of, i. 229, 230; instances of, 229; of the patriarchs, 230; why diminished, ib.
 Lori, its singular figure, i. 487; what place it holds among four-handed animals, 494, 495 n.; the genus described, 487 and 495 n.
 Loricaria, account of the fish, ii. 288.
 Lories, white parrots, ii. 107; described, 110 n.
 Louise, its nauseous nature, ii. 413; appearance through the microscope, 414; its trunk or sucker, ib.; how used by it, ib.; whether hermaphrodites, ib.; rapid multiplication, ib.; disease caused by the, its ancient prevalence, ib.; infests almost all animals and vegetables, 415; varieties, the leaf, ib. and n.; where found, and the colour of the, 415; young, ib.; retreat in the winter, 416; casts the skin four times, ib.; enemies, ib.; wood, the, an account of, 417, 418.
 Louvain, echo near, i. 158 n.
 Luminous appearance of the waves by night, i. 135.
 Lump-fish, the, account of, ii. 280; where found, ib.
 Lungs, Int. xxviii.
 Lurcher, mongrel dog, described, i. 406 n.
 Lynx, Ray's mistake concerning the, i. 376; distinguished from the panther kind, ib.; described, where found, 378; method of taking its prey, ib.; its eyes, bad memory, &c., ib.
- ### M
- Macaguo, a kind of monkey, i. 485.
 Maccaw, the large parrot, ii. 107; varieties, 110 n.
 Macgillivray, his account of the habits of the curlew, ii. 188, 189 n.; of the king-fisher, 237, 238 n.
 Mackerel, the fish noticed, ii. 285; gregarious, 302 n.; migratory, 301 n.; account of the fishery of, 302 n.; said to be fond of human flesh, ib.; how they pass the winter, 301 n.
 M'Laurin, Professor, his jaw said to be dislocated by yawning, i. 203; this mistake corrected, ib. n.
 Madness, case of, caused by music, i. 221; one cured by music, ib.
 Madrepore, a coral insect, ii. 498 n.; where found, ib.; the truncated, ib.; the cup, ib.; the mushroom, ib.
 Maelstrom, a dreadful whirlpool, description of the, i. 140.
 Maestricht, stone quarry of, its size and beauty, i. 84.
 Magellan, his voyage, and discovery of giants, i. 246, 247.
 Magot, a kind of ape, its capability of instruction, i. 479 n.
 Magpie, general characters of the tribe, ii. 88; description of the, ib.; insolence of the, 89; food, ib.; architecture of its nest, ib.; whether it has a second opening, ib. n.; its haunts, 90 n.; what trees it selects for the nest, ib.; prejudices against the, 88 n.; protected by Waterton, ib.; its character, in the tame state, 90; story of a magpie committing theft, for which a girl suffered death, ib. n.; considered in Scotland as a bird of omen, ib.
 Mahometans, their treatment of women, i. 199; of their wives, ib.
 Mahouts, the Indian keepers of the elephant, i. 506 n.
 Maid and Magpie, a drama, its origin, ii. 90 n.
 Maida, a Highland wolf-dog, possessed by Sir W. Scott, history of, i. 400 n.
 Maimon, a kind of baboon, noticed, i. 481.
 Maki, a kind of monkey, described, i. 486.
 Malacopterigii, soft-finned fish, ii. 284; varieties specified, 286—292 and n.
 Malays, a race of men, i. 242 n.
 Malbrouk, a kind of monkey, i. 485.
 Mallard, a kind of duck, account of the, ii. 232 n.
 Malpighi and Haller, their examination of the progress of vivification in the egg, i. 189—191.
 Mammalia, Int. xlix.; general view of the class, i. 257—260 n.
 Mammoth, tusks of the, where found, i. 505; skeletons of the, ib.; diversities of the, ib.; great depository, where, 510 n.; strange opinion of the Russians concerning the, ib.; that found near the mouth of the Lena, described by Mr. Adams, ib.; American, its similarity, 511 n.
 Man, nature of his powers, i. 179; history of, in the womb, 192—194; in infancy, 195; in puberty, 198; in manhood, 200; his shape, ib.; features, 201—206; figure, 207; size, ib. and 238 n.; weight, 207; strength, 208—210; his necessities, 210; of food, ib.; of sleep, 213; senses of, 216; old age and death, 228; various races of, 232 and 239, 240 n.; his conquest of the lower animals, 260; his influence over, 264.
 Manati, the link between quadrupeds and fishes, i. 472; described, ib.; tail like a fish, ib.; organs, ib.; where found, ib.; propagation, ib.; fat and flesh, 473.

- Manchineel apple**, a deadly poison, ii. 300; whether it infects the fishes of the seas about it, ib.
- Manchot**, a kind of penguin, ii. 215 n.
- Mangabey**, a kind of monkey, i. 485; described, 494 n.
- Manril**, a kind of baboon, described, i. 481.
- Marsena** of the ancients, whether the lamprey, ii. 276; celebrated at Rome, 277; dreadful manner in which a senator fed the, ib.
- Marmouse**, a kind of opossum, i. 488; peculiarity in its pouch, ib.
- Marmout**, species of the, i. 435; analogies to the hare, ib.; its head, hair, and claws, ib.; where found, ib.; its antipathy to the dog, ib.; its habits when domesticated, ib.; its food, ib.; and flesh, ib.; extraordinary suspension of animation in the, for more than half the year, 436; its retreat for this purpose described, ib.; the watchfulness of the, when abroad, ib.; the lodging of the, how rendered convenient, ib.; their abode secured, ib.; in what condition it reposes, ib.; account of the torpor in which it continues, ib.; breeding of the, 437; countries, and names in different, ib.
- Marikina**, monkey, i. 486.
- Marsh-frillary**, a kind of butterfly, account of the, in its various states, ii. 449 n.
- Marsupials**, or pouched animals, account of the class of, i. 495—497 n. See *Pouched animals*.
- Marten**, its size, characteristics and beauty, i. 416; described, ib.; the yellow-breasted, described, 417; its graceful motions, &c., ib.; formidable to animals larger than itself, ib.; account of one kept by Buffon, ib.; where the varieties of, found, ib.; method of taken its prey, ib.; its nest, litter, &c., ib.; care of the young, ib.; country, ib.; skin, furs, and commerce in them, ib.; the Guinea, described, 417 n.; the woolly of Cayenne, described, 418 n.
- Mary queen of Scots**, her danger from a stag hunt, i. 346 n.
- Mason-bees**, their cells described, ii. 463.
- Mastiff**, the, described, i. 383 and 409 n.
- Matin**, French dog, its properties, i. 400.
- Mavis**, its lively song, ii. 128 n.; numbers with us augmented at seasons by migratory thrushes, ib.; its ingenious nest described, ib.; one built on a harrow, 128, 129 n.; feeds on snails, 129 n.; Grahame and Syme's account of the, ib.
- May-bug**, the, described, ii. 475; male and female, ib. 476; eggs, 476; maggot state, described, ib.; chrysalis state, ib.; fly state, ib.; flight, ib.; propagation and enemies, ib.; injuries of the, to roots, 477; different kinds of grubs, ib. n. See *Grub*.
- Maximin the emperor**, his size, strength, feats, and fortune, i. 209.
- Mechanics**, objects of, Int. viii.
- Mediterranean sea**, its remarkable currents, i. 139; opinion concerning, ib.; how replenished, ib.; its terrors diminished, 140.
- Medullary substance**, Int. xix.
- Medusa Funnel**, a kind of sea anemone, ii. 491 n.
- Meleagris**, old name of the pintado, ii. 67 n.
- Membranes**, effect of age on the membranes of the body, i. 228.
- Memory**, Int. xxxii.
- Managerie**, experiments in Wombwell's, i. 366 n.; in Atkins', 373 n.
- Mendip mines**, putrefying atmosphere in, i. 87.
- Mercury**, effect of heat on, i. 119 n.; used in the thermometer, ib.
- Merino**, continental race of sheep, described, i. 319 n.; different breeds of, ib.; fleece of described, ib.
- Merlin**, a kind of hawk, ii. 44 n.
- Mestizos**, who, i. 241 n.
- Meteors**, or atmospheric phenomena, i. 170; remarkable at the poles, 173; at the tropics, ib.; ignis fatuus, 173 n.; at Jamaica, 174; at Quito, ib.; seen at Bononia, ib. and 177 n.; that of 1783, 177 n.; beautiful, seen at Quito, 174; meteors of the polar regions, 175 and 178 n.; meteoric illusions, 176.
- Meteoric stones**, their appearance and ingredients, i. 177 n.; different theories concerning, 178 n.
- Mexico**, volcanoes in, i. 95 n.
- Mica schist**, i. 84 n.
- Mico**, a kind of monkey, i. 406; one described, ib.
- Migration of birds**, an account of the, ii. 10, 11; observations on the supposed analogy between migratory and hibernating animals, 12 n.
- Milk**, the nourishment of infants, i. 196.
- Milo**, his strength, i. 209.
- Milton**, his description of the first sensations of Adam alluded to, i. 226; a parallel to, by Buffon, 227, 228; his notion of the cormorant vindicated, ii. 203.
- Mind**, growth of the human, i. 197, 198.
- Mineral waters**, their classes and properties, i. 118 n.
- Mines**, depth of, i. 80, 86 n.; noxious atmosphere in, 87, 90 n. See *Damp*, and *Gas*.
- Mire-drum**, or bittern, account of the, ii. 180, 181.
- Mississippi**, course of the, i. 125.
- Mitchell**, James, a boy born blind and deaf, account of, i. 223 n.
- Mocking bird**, American, its appearance, ii. 127; habitudes, ib.; its note, 132 n.; the, described by Pennant, Barrington and Wilson, ib.; varieties in its notes, 133 n.
- Mococo**, a beautiful monkey, its appearance and habitudes, i. 486.
- Modena**, country round, remarkable composition of the layers of earth there, i. 143.
- Mole**, the, described, i. 449; its country, 450; unknown in Ireland, ib.; its legs, teeth and tongue, ib.; adaptation of its form for digging, ib.; its eyes, ib. and 452 n.; its prey, 451; sufferings from inundations, ib.; propagation, ib.; where found, ib.; white ones, ib.
- Mollusca**, Int. xxxvi, xlviii.; their utility in supporting other animals, ii. 325, 326 n.; quadrupeds, 326 n.; birds, ib.; as bait, ib. and 327 n.; fishes, ib.; many carnivorous, ib.; their composition, ib.; a Linnæan tribe of worms, 491 n.
- Molossum**, the famous dog of, described, i. 400 n.
- Mona**, a monkey, described, i. 485; its elegance, colour, &c., 494 n.
- Monax**, the marmout, in Canada, i. 437.
- Mongolian race of men**, its characteristics, i. 240 n.
- Mongoz**, a kind of monkey, i. 487.
- Monitor**, the, distinguished from the crocodile, ii. 368 n.; the, of Congo, described, 369 n.; of Egypt, ib.; the variegated of New Holland, ib.; habits of that of Guiana, ib.
- Monkey kind**, animals of the, their characteristics, i. 474 and 489 n.; varieties of head, body and limbs, 489 n.; the tail, ib.; adaptation of parts to their uses, ib.; congregations and peregrinations of the, ib.; irritability, ib.; intelligence, 490 n.; varieties in the old and new world, ib.; different arrangements, ib.; Camper's, ib.; its fallacy, ib.; why descriptions general, ib.; varieties in the class, 474; ape, ib.; baboon, ib.; monkey, ib.; opossum, ib.
- Monkey**, varieties of the, numerous, i. 481; their numbers in tropical climates, 482; dispositions, ib.; pests of other animals, ib.; contests with the serpent tribe, ib.; enmity to mankind, ib.; with difficulty caught, 483; pleasure of the Negroes on seeing them killed, ib.; how they injure corn, &c., ib.; and escape pursuit, ib.; discipline of the, ib.; cry, 484; propagation and care of the young, ib.; amusing when tame, ib.; Sir Thomas More's, defended rabbits from a weasel, ib.; their care of Father Carli, ib.; those of Africa the most entertaining, 485; varieties of the, 485, 486 and

- 493, 494 n.; the red of Pennant, its peculiar colour and description, 485 and 493 n.; the collared white eyelid, its colour and structure, 494 n.; the striated, its size, form, habits, &c., ib.; one brought to England, ib.; the entellus, its country, ib.; several accounts of the, ib.
- Monocotyledones, *Int.* xlviii.
- Monoculus, or water-flea, seems to have but one eye, *ii.* 418; red colour, *ib.*; causes the water to appear red, *ib.*; the insect described, *ib.*; the canceroid, *ib.* n.; the four-horned, *ib.*
- Monsoons, origin of the word, *i.* 161 and 169 n.; account of the, 169 n.; how announced, 169.
- Monsters, what, described, *i.* 243; account of one by Malebranch, *ib.*; dwarfs, 244, 245; giants, 246.
- Montaigne, his story of the fascinating power of the cat, *i.* 360 n.; his account of the halcyon's nest, *ii.* 236 n.
- Moon, her effect in producing tides, *i.* 136.
- Moose-deer, American name for the elk, its size, *i.* 339. (See Elk); the gray, *ib.*; the black, *ib.*
- More, Sir Thomas, had a tame monkey, which defended his rabbits from the aggressions of a weasel, *i.* 484.
- Mormyrus, account of the fish, *ii.* 292.
- Morse, the, its description, *i.* 472; habits, *ib.*; numbers decreased, *ib.*; value of their teeth, *ib.*; great numbers killed by the Greenlanders, *ib.*
- Moth, the, or Tinea, account of the, *ii.* 448 n.; how prevented or killed, *ib.*; eggs, &c., *ib.* See Tinea.
- Mother-of-pearl shells, composition of, according to Hatchett, *ii.* 322 n.; whence obtained, 336.
- Motion, voluntary, *Int.* xxvi.
- Mouflon, the sheep in a wild state, its character, *i.* 302 and 305. See Musmon and Argali.
- Moulting season of birds, account of the, *ii.* 7.
- Mountains, inequality of their size, *i.* 106; theories concerning, *ib.*; uses of, 107; appearance of, *ib.*; some remarkable, 108, 109; the highest, 109; disruptions of, 110, 111 and n.; snowslips on, 111; swallowed by earthquakes, *ib.*; height of, how determined by the barometer, 149.
- Mountain-finch, account of the, *ii.* 150 n.
- Mouse, its dispositions, *i.* 443; timidity and enemies, *ib.*; propagation, *ib.*; fecundity, 444 and n.; varieties, *ib.*; the long-tailed field, described, *ib.*; short-tailed field, *ib.*; the shrew, described, 445; the wood, described, its country and habits, 446 n.; the harvest, its small size, *ib.*; its nest and habits described by Mr. White, *ib.*
- Moustoc, or white-nosed monkey, *i.* 485.
- Mouth, its expression, *i.* 202.
- Mulattoes, who, *i.* 241 n.
- Mulberry leaves, the best food for the silk worm, *ii.* 453.
- Mule, how engendered, *i.* 284 and n.; some cases of their having young, *ib.*; its serviceableness, 284; in Spain, *ib.*; dexterity in descending precipices, *ib.*; between the goldfinch and canary (see Goldfinch).
- Mullet, its method of escaping from the seal, *i.* 471; notice of the, *ii.* 286.
- Mullus, the fish discriminated, *ii.* 285.
- Multivalve shell-fish, *ii.* 324 and 341.
- Mummies, commerce in, *i.* 250; supposed medicinal, *ib.*; method of searching for, 251; in what state found, *ib.*; account of one dug up at Auvergne, 251, 252; conjectures concerning, 252; one found at Kilsyth, *ib.* n.
- Muscardin, a kind of dormouse, *i.* 445.
- Muscles, *Int.* xx, xxvi.
- Muscles, human, their strength, *i.* 208, 209.
- Music, how produced, *i.* 220; pleasures of, *ib.*; strange instances of the effects of, 221 and n.; case of madness produced by, *ib.*; cured by, *ib.*; bite of the tarantula said to be cured by, *ib.*
- Musk animal, what known of it, *i.* 324, 325; described by Grew, 325 and 326 n.; the Thibetian, its appearance and habits, 326 n.; Indian, described, *ib.*; Guinea, *ib.*; Meminna or Ceylon, *ib.*; Java, *ib.*; Brazilian, *ib.*
- Musk, pigmy, *i.* 314 and n.
- Musk-bag, strong perfume of the, *i.* 325; its qualities, *ib.*; its strength when first extracted, 326 n.; how obtained, 325; whence, *ib.*; probable counterfeits, *ib.*
- Musmon, a kind of wild sheep, described, *i.* 305; known to the ancients, 320 n.; Corsican, described, *ib.*
- Musquito fly, where common, *ii.* 486 n.; effects of its bite, *ib.*
- Mussel, the fish and shell, described, *ii.* 333; generation, *ib.*; eggs, *ib.*; fecundity, *ib.*; multitudes, 334; enemies, *ib.*; afraid of storms, *ib.*; attaches itself to rocks by filaments, *ib.*; its instrument of motion, *ib.*; its furrow in the sand, *ib.*; stockings made at Palermo, of its beard, *ib.* and n.; where found, *ib.*; in some instances poisonous, 340 n.; instance at Leith, *ib.*; to what owing, *ib.*
- Mutina, remarkable earthquake in, *i.* 98.

N

- Nails, human, their properties, *i.* 206.
- Narwhal, or Sea-Unicorn, its size, *ii.* 259; its remarkable projecting tooth, *ib.*; a skull in the Stadthouse having two, *ib.*; how it uses the tooth, *ib.*; whether a horn or tusk, *ib.*; its peaceable disposition, 260; associates with the whale, *ib.*; distinguished from it, *ib.*; value of the ivory of its tooth, *ib.* and n.; the fossil, has given origin to the stories of the unicorn, 260; a different species mentioned by Fabricius, *ib.* n.
- Natural history, defined, *Int.* vii.; *i.* 57.
- Nature, laws of, *Int.* vii.
- Nature, replete with life, *ii.* 498.
- Nautilus, a kind of sea-snail, *ii.* 332; two kinds, from the colour of the shell, *ib.*; the shell described, *ib.*; disengages itself from the shell, *ib.*; the appearance of the, sailing in the Mediterranean, *ib.*; object of its flight, 333 (see 332 n.); the shell, by what fish navigated, 327 n.
- Nazareth, bird of, whether the dodo be the, *ii.* 21, 22.
- Neck, the, its use, *i.* 206.
- Needle-fish, account of the, *ii.* 282 n.
- Negroes, vivacity of their infants, *i.* 195; their treatment of women, 199; of Africa, described, 235; darkness of complexion, 237; some, with white skins, 238.
- Nero, a tame lion in Wombwell's menagerie, *i.* 366 n.
- Nervati, wild sheep, described, *i.* 319 n.
- Nerves, *Int.* xxi.
- Nervous fluid, *Int.* xxi, xxii.
- Ness, river, near Bruges, phenomena of its mouth, *i.* 143.
- Nests of birds, their structure, *ii.* 8, 9 and n.; of the sparrow, jay, wren, &c., 8, 9 n.; hanging, of the woodpecker, described, 95.
- Nettles, sea, star-fish, or anemones, why so called, *ii.* 491.
- Newfoundland dog, size and strength of the, *i.* 402 n.; docility and sagacity, *ib.*
- Newmarket, horse-races established at, *i.* 280 n.
- Newt, black water, its class, *ii.* 370; not inconsumable, *ib.*; absurd remark on the, in the Philosophical Transactions, *ib.*
- Newton, Sir Isaac, his discovery of the law of gravitation, *i.* 61 n.
- Niagara, falls of, on the St. Lawrence, *i.* 126, 127 and 129 n.
- Nicojack cane, *i.* 85 n.
- Nictitating membrane on the eyes of birds, what it is, *ii.* 5.
- Nieper, its course, *i.* 124.

- Niger, conjectures concerning the, i. 124 and 128 n.; Park's determination of its direction, 129 n.; its source and direction, ib.
- Night, an African, described, i. 263.
- Nightingale, song of the, ii. 134; described by Pliny, 134, 135; migrations and habits, 135; its note in England, ib.; nest and eggs, ib.; song in confinement, ib.; Gesner's anecdotes of its power of talking, 135, 136; how taken, 137; and reared, 137, 138; Virginian, its note, 133 n.; lines from Coleridge on the, 135 n.
- Nile, cause of its inundations, i. 129 n. 125; source of the, 124; Bruce's visit to it, and his merits, 129 n.; length of the, ib.; benefit of its inundations, 125, 126; rivers received by, 125.
- Nose, its position and form, i. 202; peculiar to man, ib.
- Nostrils, additional, of the fallow-deer, i. 335 n.; their use, ib.
- Notes, i. 220. See Tones.
- Notonecta, or water-fly, described, ii. 437.
- Numidia, bird of, ii. 67. See Pintado.
- Nut-hatch tribe, characters of the, ii. 100 n.; of the European, 101 n.; its food, ib.; female and young, ib.; manner of sleeping, ib.
- Nutrition, Int. xx, xxvii.
- Nyl-ghau, a species of antelope, described, i. 522 and 523 n.; how far diffused, 523 n.; habits in captivity, 523 and n.; manner of fighting, 523; where indigenous, ib.
- O
- Oakey-hole, a cavern, description of, i. 84.
- Observation, Int. ix.
- Ocean, its extent, i. 131; divisions of, ib.; estimate of its bulk, ib.; its uses, 131, 132; parts of, claimed by nations, 132; its bays, &c. minutely known, ib.; saltiness of the, ib.; why not putrefied, 133; attempts to deprive sea water of its saltiness, ib.; effects of the putrefaction of the, ib. 136; advantages of its saltiness, 134; freezes, ib.; luminous appearance of its waves by night, 135 and n.; tides of the, 136. (see Tides); circulates round the globe, 138; currents of the, ib. (see Currents); its various motions, 140; its effects on the earth, 141; lands gained from the, 142; inundations of the, ib.; temporary depredations of the, 143 and n.; wonders in the bottom of the, 145; its waters at different depths, 146; its great profundity, 145 n. 146.
- Ocotzimtzcan, or Mexican pigeon, ii. 115.
- Odour, not a true test of wholesomeness, i. 225; taste of different nations with respect to, ib.; how varied by distance, ib.; by mixture of ingredients, ib.; by disease, ib.
- Oliver, W., a viper catcher at Bath, discovered salad oil to be a cure for the viper's bite, ii. 389.
- Ondatra, a kind of musk rat, described, i. 446. See Rat, musk.
- Onocratalus of Brisson, the pelican genus, ii. 199 n.
- Oolite formation, i. 83 n.
- Ophidium, a beautiful fish, described, ii. 285.
- Opossum, animals of the, kind, their relative position, i. 487; their pouch, 495 n. (see Pouched animals); the head, &c. described, 487; their bag or pouch described, and how the young accommodated in it, 487, 488; habits, 488; varieties, 488, 489 and 496, 497 n.; the Virginian, 496 n.; habits, ib.; odour, ib.; Mexican, ib.; short-tailed, 497.
- Oran-outang, different names of the, i. 475 and n.; its sizes, ib.; a young pongo, 490 n.; description of one from the Hurkara newspaper, ib.; Dr. Abel's description of it, from communications with Captain Cornfoot, ib.; its countenance, 491 n.; hands, ib.; description of that seen by Dr. Tyson, 475; its resemblance to the human figure, and
- essential difference, ib.; its hair, hands, &c. 476; dispositions, ib.; that seen by Edwards, described by Buffon, ib.; history by Abel of the life and habits of that brought from Java to England, 491 n.; intelligence of two belonging to L. Brosse, 476; smaller tribe, 477; Le Compte's account of it, ib.; the gigantic species, ib.; where found, ib.; the African, or pongo, described, ib.; go in companies, ib.; size, strength, &c., ib.; place of the, in the gradation of nature, 478; helplessness of the, ib.; goes on all-fours, ib.
- Orb, sea, the, described, ii. 281; the shield, ib.; lesser, ib.
- Order, what, Int. xi.
- Orford, Earl of, improver of the breed of greyhounds, i. 401 n.
- Organic productions, classes of, i. 76, 80 n. See Fossils.
- Organization, what, Int. xiv, xlii.
- Orgasm, Int. xxiii.
- Oriole, the Baltimore, its song, ii. 133 n.; the orchard, ib.; nests of the, ib.; varieties of the Baltimore's nest, ib.; uses thread and silk in its construction, ib.
- Ornaments of the person, savages admire, i. 204; observations concerning, 205.
- Ortolan, a kind of bunting, ii. 152 n.; how fattened, ib.
- Osprey, or Ossifrage, a kind of eagle, ii. 30; its country, ib. n.; prey and nest, 31 n.
- Ostracion, the, a kind of fish, described, ii. 281 and 282 n.
- Ostrich, its appearance, ii. 15; size, ib.; plumage, ib. 18; its value, 18; spurs, 16; thighs, ib.; internal parts, ib.; where found, ib.; habits, ib.; voracity, ib.; incubation and polygamy, 17 and n.; manner of running, 18; how hunted, ib.; domesticated and tamed, ib.; its flesh, ib.
- Otter, the, described, i. 463; where found, ib.; prey and manner of fishing, ib.; propagation, 464; its retreats and habitation, described, ib.; how caught by dogs, ib.; trained to hunt fish, ib.; countries of the, 465; the sea, its size and form, ib. n.; attachment to the young, ib.; behaviour when attacked, ib.; trade in their fur, ib.; the Cayenne, described, ib.
- Otter-hound, described, i. 406 n.
- Ouarine, a species of monkey, its significant voice, i. 483.
- Ounce, confusion concerning the name, i. 375; that of Linnaeus, described, ib.; disposition of the, 377; method of taking their prey, ib.; how used in hunting, ib. and 378.
- Ousely, Sir Gore, his remark concerning the ruins of Persepolis, i. 277 n.
- Ovid, his description of the metamorphosis of the halcyon, ii. 236 n.
- Owl, nocturnal, bird of prey, ii. 49; the common properties of the, 52 n. 49, 50; divisions of the, 52 n. and 50; of horned owls, the great horned or eagle, 52 n. 50; long-eared or common horned, ib.; short-eared, 53 n.; scops-eared, ib.; of smooth-headed, the snowy, 53 n. 50; barn or white, 53 n.; hunts mice, 52; tawny, 53 n.; little, ib.; the appetites, habits, retreats of the class, 50; cry, ib. 51; antipathy of other birds to the, 51; how used to lure the kite, ib.; nest of the, ib.; indocility of the, 52; instance of a young, being fed by its parents in a coop, ib. n.
- Oxford, Lord, his experiment with tame stags, i. 329 n.
- Oxney island produced by the sea, i. 142.
- Oxygen gas, a component of air, i. 156 n.
- Oyster, the, its resemblance to the mussel, ii. 335; its shells, described, ib.; cannot move its situation, ib.; exceptions, ib. n.; to what it attaches itself, 335; by what means, ib.; spawn, ib.;

- growth, *ib.*; deposited in beds at Colchester, *ib.*; quantity taken, 337 *n.*; regulations, 338 *n.*; artificial beds, *ib.*; oyster-market at Billingsgate, *ib.*; what coasts of Britain famous for, *ib.*; viviparous, *ib.*; when in season, 339 *n.*; species peculiar to several shores, *ib.*; size of those on the coast of Coromandel, 335 and *n.*; pearl oysters, 336, and 340, 341 *n.*; mistake among foreigners concerning the English, 340 *n.*; instances of its having caught mice, 326 *n.*
- P**
- Paca, its characteristics, *i.* 438; roots like a hog, *ib.*; where found, *ib.*; its numerous enemies, *ib.*; courage, *ib.*
- Pacific ocean, constancy of its winds in certain latitudes, *i.* 160.
- Paco, a kind of llama, *i.* 521.
- Paddock moon, the month in which frogs do not croak, *ii.* 351; accounted for, *ib.*
- Pagurus Bernhardus, *Int.* xlv.
- Painters, their observation of the expression of passions by the human body, *i.* 203.
- Paleness, the effect of what passions, *i.* 203.
- Pangolin, or scaly lizard, distinguished from the lizard tribe, *i.* 456, 457; size and appearance, 457; its scaly covering, *ib.*; a sufficient defence against all animals but man, *ib.*; harmlessness of the, *ib.*; its food, *ib.*; tongue, *ib.*; preys on ants, *ib.*; its habits, *ib.*
- Panther, the great, *i.* 374; distinguished from the leopard, *ib.*; its spots, *ib.*; dispositions, 376, 377.
- Paoli, Pascal, brought a specimen of the wild sheep of Corsica to England, *i.* 320 *n.*
- Papegais, a kind of parrot, *ii.* 110 *n.*
- Paper, a kind of, manufactured by the wasp, *ii.* 464, 465 *n.*
- Papuas, a race of men, *i.* 240 *n.*
- Paradise, bird of, mistakes concerning the, *ii.* 101; its characters, *ib.*; the two varieties of the, *ib.*; the animal described, 102; where found, *ib.*; migrations of the, *ib.* and *n.*; how shot and preserved, 102; the grackle bird, described, *ib.* *n.*; the magnificent bird, *ib.*
- Pariab, the common village dog of India, described, *i.* 399 *n.*
- Parr, his longevity, *i.* 229.
- Parr, the young of the salmon, *ii.* 288, 289 *n.*
- Parrakeets, what, *ii.* 107; varieties, 110 *n.*; beauty and talkativeness of the Brazilian, 108.
- Parrot taught to flatter Augustus, *i.* 508 *n.*; its docility, *ii.* 106; taught to speak, *ib.*; Willoughby's story of one belonging to Henry VII., *ib.*; numerous varieties of the, *ib.*; peculiarities in the toes of the, 107; in the bill, *ib.*; the tongue and throat, *ib.*; its climate, *ib.*; expertness of the, taught in France, *ib.*; cause, *ib.*; of the Brazilian, *ib.*; account of one, *ib.* 108; sagacity in a state of nature, 108; eggs and young, *ib.*; how taken, *ib.*; flesh of the, *ib.*; beauty of the Brazilian, *ib.*; how found and shot, *ib.*; abundance of the, 109; skill in climbing, 110 *n.*; habits, *ib.*; food, *ib.*; haunts, 111 *n.*; sleep, *ib.*; age, *ib.*; diseases, 109; varieties, *ib.* and 110 *n.*
- Partridge, *ii.* 74; delicacy of the flesh of the, 74, 75; the animal described, 74 *n.*; universal diffusion of the, 75; vengry, *ib.*; care of its young, *ib.*; partridge-shooting, *ib.*; the, never thoroughly domesticated, 76.
- Passions expressed by the features of the face and attitudes of the body, *i.* 203.
- Patas, or African monkey, *i.* 485; size, 493 *n.*; limbs, *ib.*; habits, *ib.*
- Paul, St., de Leon, in Lower Brittany, country round, desolated by a sand storm, *i.* 166.
- Paul's, St., Cathedral, whispering gallery there, *i.* 159 *n.*
- Peacock, its beauty, *ii.* 59; scream, *ib.*; seen in flocks, *ib.*; early domesticated, *ib.*; considered a delicacy by the Romans, 60; in the times of Francis I., *ib.*; its food, *ib.*; salacity, *ib.*; flocks of them in Cambaya, *ib.*; varieties, the Thibet, *ib.* 61 *n.*; the Japan, 60, 61 *n.*; the Chinese, 61 *n.*
- Peacock butterfly, account of the, in its several transformations, *ii.* 449 *n.*
- Peahen, number of her eggs, *ii.* 60; her age, *ib.*
- Peak, a mountain in the Molucca Islands, swallowed by an earthquake, *i.* 111.
- Pearls, whether a disease or an accident of the oyster, *ii.* 336; from what fishes obtained, *ib.*; fisheries of, *ib.* and 340 *n.*; how conducted, *ib.*; comparative value of pearls, *ib.*; whence the best, 337; in what part of the oyster found, 340 *n.*; one said to be found in Conway, *ib.*; others in Ireland, *ib.*; traffic in pearls, *ib.*; account of the divers for, 337.
- Peccary, animal of the hog kind, *i.* 352; its abode and habits, *ib.*; odorous lump on its back, 353; colour, hoofs, &c. described, *ib.*; herds of the, *ib.*; food of the, *ib.*; flesh, *ib.*; the young of the, *ib.*; distinct from the hog, 354.
- Peewit, name for the lapwing, *ii.* 193 *n.*
- Pegasse, a kind of buffalo, accounts of, by travellers, *i.* 299 *n.*
- Pegu, the Indian Nile, *i.* 125.
- Pelagii, shell-fish of the deep, *ii.* 324.
- Pelican, described, *ii.* 199 and 200 *n.*; the Linnæan class of the, 199 *n.*; size of the, 199; account of the pouch of the, and its use, *ib.*; ancient notions of the, *ib.*; Labat's account of the, 200; indolence, *ib.*; except to satisfy gluttony, *ib.*; female and young, *ib.* 201; for what purpose killed by the Americans, 201; Raymond's account of a tame one, *ib.*; Faber's, of one that had a taste for music, *ib.*; age of the, *ib.*; account of one in the Tower of London, 200 *n.*; the red-backed, described, 205 *n.*
- Pen, Sea, the, a kind of coralline insect, *ii.* 499 *n.*
- Penguin, characteristics of the species, *ii.* 212; wings, *ib.*; legs, 213; power of diving, *ib.*; colour, *ib.*; the crested, its beauty, 214 *n.*; the bird, described, *ib.*; disposition, *ib.*; nests and eggs, *ib.*; Patagonian, *ib.*; Magellanic, 213; described, *ib.*; food, *ib.*; flesh, *ib.*; social disposition, *ib.*; its remarkable nest, *ib.*; female and eggs, 214; immense numbers in Macquarrie Island, 214 *n.*
- Penparkhole, a cavern, Captain Sturmy's descent into, *i.* 85.
- Perch, notice of the fish, *ii.* 285.
- Perching birds, Aristotle's remark concerning, illustrated, *ii.* 233 *n.*; exceptions to it, *ib.*
- Perception, *Int.* xxxii.
- Perfumes, *i.* 225. See Odours.
- Periwinkle, its class, *ii.* 339 *n.*; eaten, *ib.*
- Persepolis, no sculpture of horses there, *i.* 277 *n.*; argument thence, *ib.*
- Persia, dreadful wind in, *i.* 164; its breed of horses described, 272, 274; hawking in, *ii.* 46 *n.*
- Pesce, Nicola, the diver, account of, from Kircher, *i.* 146, 147.
- Petauristæ, or flying philangers, described, *i.* 497 *n.*
- Petrel, the, whence so called, *ii.* 210 *n.*; manner of skimming and diving during a gale or storm, *ib.*; presages storms, *ib.*; sensible of danger, *ib.*; their cry then, *ib.*; where they breed, and the noise they make in hatching, *ib.*
- Petrifications, of what substances found, *i.* 76—80 *n.* See Fossils.
- Phæton or Tropic birds, described, *ii.* 205 *n.*
- Phatagin, variety of the pangolin, described, *i.* 458.
- Pheasant, at first artificially propagated among us, *ii.* 64; brought from Phasis, *ib.*; beauty of the, *ib.*

- 65; the animal described, 65; its flesh, *ib.*; manner of hatching, 66; easily taken, *ib.*; or shot, *ib.*; how domesticated and reared, *ib.* and 65 n.; breed between the, and the common hen, 66; varieties, *ib.*; the golden of China, *ib.* and n.
- Philanger, a species of opossum, how distinguished, i. 458 and 497 n.; habits of the, *ib.*; the vulpine, its size, *ib.*; description, *ib.*; country, *ib.*; the philanger of Cook, its size and colours, *ib.*
- Pholas, or file-fish, ii. 342; where found and in what situation, *ib.*; shell of the, *ib.*; the animal described, 342, 343; power of penetrating hard substances, proved, 343; perseverance and slowness, *ib.*; numbers meet in the same rock, *ib.*; where found, *ib.*; phosphorescent fluid of the, and its properties, *ib.* n.
- Physics, general and particular, *Int.* vii, viii.
- Physiognomy, how marked, i. 201.
- Pie kind, birds of the, what class included under, ii. 77; teasing and noxious, 78; places of building, *ib.*; republican government, *ib.*; archness, and capability of instruction, *ib.*; other characteristics, *ib.*
- Pigeon, varieties in Africa with robust bill, ii. 111 n.; moderate, *ib.*; slender, *ib.*; fecundity and domestication, 111; original species, the stock-dove, described, 112; example of the social instinct of the, misapplied, 114 n.; the dove-house, 112 and 119, 120 n.; its eggs and young, *ib.*; method of feeding the young, *ib.* and n.; the crop, *ib.*; fecundity, 113; the carrier, *ib.*, 114 and n.; the ring-dove, 115 and n.; the rook, 116, 117 n.; the wild of North America, 117 n.; account of its roost, young, flight, &c., from Wilson, 117—119 n.
- Pigmy of Tyson, the oran-outang, i. 475; pigmies and cranes, origin of the fable of the, ii. 165, 166.
- Pigs, learned, i. 350 n.; a pig pointer, *ib.*
- Pigtail, a kind of baboon, noticed, i. 481.
- Pike, the, characterized, ii. 289; its voracity described, 299.
- Pilchard, its place of resort, ii. 296; arrival, how known, *ib.*; great quantities of the, how taken, *ib.*; uses, *ib.*; profits of the fishery of, *ib.*
- Pilori, a kind of musk rat, i. 446.
- Pilot, the shark's, anecdote of its directing the shark to its prey, ii. 269 n.
- Pinch, a kind of monkey, i. 486.
- Pinna, the, a kind of mussel, described, ii. 334 n.; use of its beard, *ib.*; the prickly, described, *ib.*; the giant, *ib.*
- Pintado, or Guinea hen, its resemblance to the pheasant and turkey, ii. 67; different names of the, *ib.*; feeds in flocks, *ib.*; the crested, and mitred, *ib.*
- Pipal, or Surinam toad, its loathsome appearance, ii. 358; eggs sent by internal canals to the back, *ib.*; or deposited there, *ib.* n.; the young keep on the back of the parent till they acquire strength, *ib.*; different statements concerning the, 359; the male described, *ib.*
- Pipe-fish, account of the, ii. 280; description of one taken at Salcomb, 282 n.; shorter, *ib.*; little, or sea-adder, *ib.*
- Pipits, distinguished from the lark, ii. 144 n.; habits, *ib.*; varieties, *ib.*
- Pisces, *Int.* xlix.
- Pismire, or Wood-ant, account of the, ii. 472 n.; architecture of its hill, *ib.* See *Ant.*
- Pit-coal, what, i. 76 n.
- Pithekos of the ancients, the ape, i. 478.
- Pitta, a genus of birds, ii. 134 n.
- Pivot, or Razor-shell, ii. 336 and 339 n.
- Plague, how caused, i. 154; some places free from, *ib.*; that of 1346, *ib.*; that in London 1665, *ib.*
- Plaice, the fish described, ii. 288 n.; where found best, *ib.*
- Planetary system, i. 60, 62 n.
- Planets, the five, discovered since Goldsmith's time, i. 62 n.; their names, situations, and periods, *ib.*
- Plants distinguished from animals, *Int.* xvii, xxxix.
- Platypus, duck-billed, its singular bill, i. 473 n.; the animal described, *ib.*
- Plesiosaurus, i. 80 n.
- Pleuronectes, the, or flat-fish, ii. 287.
- Pliny, the Elder and historian, his observations on the study of shells, ii. 324.
- Pliny, the Younger, his strange supper, ii. 229 n.
- Plotus Anhinga, described, ii. 203 n.
- Plover, habitudes of the, ii. 192 n.; migrations, *ib.*; the golden, *ib.*; countries in which found, *ib.*; habitudes, *ib.*; the dotterel, account of the, *ib.*
- Plummet, used to sound the sea, i. 145.
- Pluto, gulf of, i. 83.
- Poikilitic formation, i. 83 n.
- Pointers, Spanish, &c., described, i. 404, 405 n.
- Poisonous qualities of some fishes, whence derived, ii. 299, 300.
- Poisons, sucked out, ii. 357; by the toad, *ib.* See *Venom*, 387.
- Polar regions, description of the earth there, i. 66; description of the ice there, 134, 135; atmospheric phenomena of the, 172, 175, 176; the men found round the, described, 232, 233.
- Pole-cat, its size, i. 415; distinguished from the ferret, 416; its fine colours, &c., described, *ib.*; destructive to game, *ib.*; residence, *ib.*; infests dove-houses and hives, *ib.*; its fur, *ib.*; climate, *ib.*
- Pollen on the thighs of bees, Hunter's experiments concerning the, ii. 456 n.
- Polynemus, the fish described, ii. 286.
- Polypi, *Int.* l.
- Polypus, description of the, i. 188; pullulation from the, 189; multiplied by cutting, *ib.*; the fresh and sea water compared, ii. 492; Trembley's divisions of the, 493; appearance of the, in fresh water, *ib.*; properties, *ib.*; the mouth, where placed, *ib.*; their food, *ib.*; contests, 494; does not die when devoured by another, *ib.*; voracity, *ib.*; torpidity, *ib.*; in various ways propagated, *ib.*; from the egg, *ib.*; by excrescence, *ib.*; from the young, likewise, *ib.*; experiments in cutting the, *ib.* 495; varieties, *ib.*; general properties, *ib.*
- Pompey, a lion, age of, i. 366.
- Pongo, the aged oran-outang, i. 490 n. 493 n.; name given by Buttel to that in Africa, 477.
- Popinjay, whence derived, ii. 110 n.
- Poppy-bee, a species, why so called, ii. 463 n.
- Porcellaneous shells, according to Hatchett, ii. 322 n.
- Porcupine, its quills described, i. 454; how it fetches water for its young, *ib.* n.; its figure and body, 454; whether it darts its quills, 455 and n.; its method of defence, 455; prey or food, *ib.*; age, *ib.*; its escape from dogs, &c., *ib.*; how hunted by the Indians, *ib.*; fables concerning the, *ib.*; when tamed, its fretfulness, 456; varieties of the, *ib.*; sea, why the sea-orb so called, ii. 281 n.
- Pork, by what nations not eaten, i. 351 n.
- Porpoise, the, distinguished, ii. 262; whence the name, 263 n.; described, 265 n.; its agility, 262; method of seeking its prey, 263; destructive to the nets of fishermen in Cornwall, *ib.*; follows fish up fresh water, *ib.*; seen in the Thames at London, *ib.*; how killed there, *ib.*; oil from the, *ib.*; fishery on the west shores of Scotland, *ib.*; young, *ib.*; age, *ib.*
- Pouch of the opossum kind, opinions concerning the, i. 495 n.; the, described, *ib.* 487.
- Pouched animals, opinions concerning, i. 495 n.; growth of their pouch, *ib.*; whether their pouch a first or second domicile, 496 n.; distinctions among, *ib.*; their feet, *ib.*; physiognomy, *ib.*; country, *ib.*; varieties, *ib.*
- Poultry kinds, their utility, ii. 54; characteristics, habitude, *ib.* 55.

- Prawn, the, a kind of lobster, described, ii. 309 and n.
- Pregnancy, progress of the embryo during, i. 192—194; a child wonderfully affected by an execution seen by the mother, while in that state, 243.
- Prey, the law of, i. 186 n.; beasts of, their habits, 262, 263.
- Primitive rocks, i. 72 n.
- Prince of serpents, a beautiful species in Japan, ii. 396; a favourite there, ib.
- Propolis, the substance with which bees stop crannies in their abodes, ii. 457; whence collected, 461 and n.
- Proportions of the human body, i. 207.
- Proteus anguinus, where found, ii. 372 n.; described, ib.
- Pteropoda, Int. xlix.
- Pinus, death-watch, described, ii. 483 n.; manner of producing sound, ib.; its instinct in counterfeiting death, 408 n.
- Puberty, season of, i. 198; its time in different countries, ib.; symptoms of, ib.
- Puffin, bill of the, described, ii. 215; legs, ib.; migrations for the purpose of hatching, ib.; dangers undergone then, ib.; enemies, 216; disposes the rabbit of its burrow at Priesholm, ib.; how taken there, ib.; flesh, 217; Audubon's statement respecting its eggs, ib. n.; migration, ib.
- Pug dog, the, described, i. 407 n.
- Puma, the, called the American lion, not a lion, i. 366; nearly extirpated from America, 373 n.; why called the American lion, ib.; the puma described, ib.; cowardly and ferocious, ib.; readily tamed, 374 n.; story of its gratitude and attachment, ib.
- Purple emperor, a kind of butterfly, described, ii. 449 n.
- Pygargus, a kind of eagle, described, ii. 31 n.
- Q
- Quadrupeds, classification of, i. 256; their rank, 260; utility, ib.; analogies to man, ib.; their adaptation to their stations, 261; different structures of their heads, ib.; teeth, ib.; legs, 262; stomach, ib.; their hostilities, ib.; seasons of seeking prey, 263; defences, ib.; causes of variety among, 264, 265; their comparative size in the different continents, 265; their generation, 266; courage and art in defending their young, ib. 267; seasons of breeding, 267; those from the egg, ib.; those covered with scales instead of hair, their distinguishing qualities, 456; amphibious, their characteristics, 462, 463; observations on the subservience of quadrupeds to man, 535.
- Quadrumania, four-handed animals, the monkey kind, i. 474 and 489 n.; their comparative advantages, 488, 489. See Monkey.
- Quagga, animal of the zebra kind, described, i. 286 n.; where found, 287 n.; is gregarious, ib.
- Quail, the, described, ii. 76; account of the migration of the, ib. and n.; quail-fighting among the Athenians, 76; how caught by a call, ib.; the Virginian, 76 n.; the Californian, 77 n.; traffic in quails, ib.
- Queen bee in a hive, ii. 455; her eggs, 458; train, ib.; fructification of the, ib. n.
- Quito, a city on the Andes, i. 108; its height, 109; appearance of meteors there, 174; the wild-ass how hunted there, 282.
- R
- Rabbit, stages of generation in the, i. 191, 192; distinct from the hare, 429; makes holes for security, 430; loves the fields, ib.; sometimes brings forth at a distance from the warren, ib.; description of the apartment in which the female brings forth, ib.; the tame, does not burrow, ib.; various colours of the domestic breed, ib.; account of the production and subordination of some domestic ones, ib.; age of the, 431; flesh, ib.; multiplication of the, in Spain, ib.; prefers a warm climate, ib.; tame, the larger, ib.; the Syrian, ib.; none in America, ib.
- Race, human, varieties in the, i. 231, 239 n.; difference small, 232; classification of the, 239, 240 n.; several, described, 232; in the polar regions, ib.; the Tartars, 233; Southern Asiatics, 234; Negroes, 235; Americans, ib.; Europeans, 236; diversified by colour, 236, 237 and 240 n.; stature, 238 and n.; face, 238 and 242 n.; all from one common stock, 238, 239.
- Races, horse, ancient, in Smithfield, i. 278 n.; established in England, 279 n.; established in Hyde-park and Newmarket, 280 n.; the effects of, on the breed of horses, 275.
- Racoon, called the Jamaica Rat, its description, i. 528; abode, 529; injurious to plantations, ib.; capable of being tamed, ib.
- Radiata, Int. xxxvii, xlviii.
- Raenal, his accurate history of the frog, ii. 348, 349.
- Rails, birds, whence so called, ii. 196 n.; habits of the, ib.; account of the water-rail, ib.; land-rail or corn-crake, ib.
- Rain, how produced, i. 171, 172.
- Rain-water, its impurity, i. 113.
- Rainbow, lunar, seen in the north, i. 175; solar, its appearance in the polar regions, 414.
- Rain-fowl, ii. 93. See Woodpecker.
- Ranking, his account of the Indian elephant, i. 502 n.; theory of the fossil, 511 n.
- Rapacious birds, their characteristics, ii. 26 n.; adaptation, ib.; habits, ib.; classification, ib.
- Rat kind, animals of the, their characteristics, i. 441; multiplication, ib.
- Rat, the great or Norway or Surmolot, its native country, i. 441; characteristics, ib. and n.; multiplication, ib. n.; its food, ib.; size, ib.; motions, perseverance, &c., ib.; migrations, ib.; hostility to the black rat, 442; see also 443 n.; extirpated frogs in Ireland, 442; its habits of rapacity, ib.; propagation, ib.; its enemies, the dog, cat, and weasel, ib.; black, the common, till extirpated by the Norway, ib.; whether known to the ancients, 443 n.; where found, ib.; abodes of the, ib.; whether any particular enmity between it and the surmolot, ib.; the animal described, 443; instance of a tame, ib. n.; black-water, its distinctions and food, 443.
- Rat, blind, i. 451 n. See Spalax.
- Rat, German, i. 447. See Crictus.
- Rat, musk, varieties of the, i. 446; the desman and pilori, ib.; the ondatra, described, ib.; disposition and manner of living, ib.; scent of the, ib.; variously esteemed, ib.
- Rattlesnake, the, described, ii. 390; its rattle, ib.; its mortal bite, ib.; symptoms, ib.; account of one, inflicted on a gentleman in Virginia, ib. 391; remedies, 391; whether agile, 392 and n.; the, easily mastered by a man, 391 n.; account of its power of fascination, 392 and n.; proof, 393; denied by Dr. Barton and Mr. Blair, 393 n.; habits of the, 392 n.; experiments of the effects of the bite on dogs, 391 n.; on the animal itself, ib.; encounter between a dog and a rattlesnake, ib.; instance of three persons killed by the fangs of a, left in a boot, ib.
- Raven, its characteristics, ii. 78; influence of climate on the, 79; the white, ib.; celebrated for talking, ib. n.; reclaimed and trained, 79; instance of a tame one terrifying the flocks of the wild, ib. n.; of one tending a bruised dog, ib.; habits in the tame state, 79; in the wild, 80; revered by some, ib.

- Ray**, his classification of animals, i. 254.
Ray kind, fish of the, their properties, ii. 279; characteristics, 271 and n.; the sharp-nosed, ib.; thorn-back, ib.; fire-flare, ib.; their size, ib.; safety from it, 272; stories of some of prodigious size, ib.; retreats of the, ib.; female and eggs, ib.; fishing of the, how practised at Scarborough, ib. 273; the Italian method, 273; injurious species, ib.
Rays, refrangibility and momentum of the, different, i. 157 n.
Razor-shell, the Irish fisheries of the, ii. 339 n.; its remarkable hole, 336; how taken, ib.
Reason in man, Int. xxxii; in animals, ib. xxxiii.
Reaumur, his thermometer, i. 119 n.
Red, aversion of the buffalo to that colour, anecdotes concerning the, i. 298 n. 300 n.
Red-bird, note of the, ii. 133 n.; of the summer, 134 n.
Redbreast, its note and habitudes, ii. 136.
Red Sea, nature of its channel, i. 145; gain of land at the head of, 142 n.
Redshank, account of the, ii. 192 n.; the spotted described, ib. 193 n.
Red-wing, description and habitudes of the, ii. 129 n. and 127.
Reflecting power of the air, i. 158 n.
Reflection of sound, i. 158 n.
Refraction of light, phenomena caused by the, i. 157, 158 n.
Rein-deer, its country, i. 340; usefulness, ib.; shape, horns, motions, ib. and n.; change of hair, colour, horns, &c., 340, 341; an attempt to introduce the, into England, 341 n.; failure of many attempts, ib.; its abode, Lapland, described, 341; enemies to the, there, 342, 345; how the natives protect it, ib.; the female, its young, 342, 343; how it spends the winter in Lapland, 342; dependence of the Laplander on the, 343 and 344 n.; the kinds of the, 343; patience of the tame, ib.; the herds of the, 344 n.; their different numbers, ib.; the milking of the, described, ib.; whence their crackling noise when running, 345 n.; their age, 343; uses of the flesh, 344; milk, ib.; skin, ib.; diseases of the, 345.
Relish, on what it depends, i. 226; how affected by circumstances, ib.
Remora, or sucking-fish of the shark, ii. 269; anecdote of the, ib. n.
Reproduction, Int. xvi, xxviii.; periods of, in different animals, i. 226 n.
Reptilia, Int. xlix.
Respiration, Int. xvii.; on mountains, i. 110.
Rhine, its fall, i. 122 n.; cataracts of the, 126; a part of, lost in the sand, 127.
Rhinoceros, size of the, i. 511; shape, ib.; horn, 512; skin, ib. 514 n.; contends with the elephant, 512; fables concerning the, ib. 513; account of that described by Parsons, 512; age, ib.; anatomical description of, by Thomas, 512 n.; country and haunts, 513; food, ib.; how taken, ib.; varieties, ib.; the double-horned, ib. and 513 n.; its skin, 513 n.; the horn said to be loose when the animal quiet, &c., ib.; Bruce's account of the animal, ib.; persecuted by a fly, ib.
Rice bird, its note, ii. 134.
Ring-dove, described, ii. 115 and 115, 116 n.
Ring-ouzel, its migrations and haunts, ii. 129 n.; song, ib.; disposition, ib.
Rivers, comparative purity of the water of, i. 113; opinions concerning their origin, 120; whence supplied, 121; in what manner, ib.; their channels, ib.; their current, 122 and n.; some without any sensible descent, 122 n.; sinuosities increase as they approach the sea, 122; some with many mouths, ib.; their rapidity how affected, 123; the largest in Europe, 123, 124; in Asia, 124; in Africa, ib.; in America, 125; inundations of, 128 n. 129 n. 125, 126; cataracts of, 126; rivers lost in the sand, 127; quantity of water in, 131.
Rock of Arabian writers supposed to be the Condor, ii. 34.
Rocks, Werner's classification of, i. 72 n.
Roe-buck, described, i. 336; varieties of colour in the, ib. n.; the haunts of the, 336; method of running, ib.; adventures of one, ib. n.; constancy of their attachment, 337; their generation, growth, cry, &c., ib.; varieties, 338.
Roller, a kind of Jay, ii. 90.
Romans, destroyed the British forests, i. 144; how their horse-races conducted, 272 n.
Rook, the, ii. 81; whether a corn-eating bird, 87 n.; food of the, ib.; roots out turfy hair-grass, ib.; meetings of young with the old, 88 n.; anecdote of their sympathy, 86 n.; amusing account of two, ib.; instance of a pair building a nest on a church vane, 81 n.; contest between rooks and herons for a rookery, ib.
Rookery, account of the form and policy of the, ii. 81, 82, and 84 n.; sympathy among its members, 86 n.
Rope-walking, elephants taught, i. 508 n.; a horse taught, ib. n.
Rouen, echo near, i. 158.
Rubia tinctorum, Int. xiv.
Ruff, the, described, ii. 185, 187; how taken, 188. and served up, ib.
Ruminating animals, the class of, i. 287; their habits, ib.; construction of their stomach and intestines, 288; peculiarities of the, ib. n.; birds, 288; fishes, ib.; insects, ib.; instance of a man ruminating, ib.; cow kind, 289; sheep and goat kind, 301; deer kind, 326.
Runner, a name of the corrija, ii. 185.
Running, power of man in, i. 208 and n.; compared with that of the horse, ib.
Rusfiberg, immense projection of the mountain of, i. 110 n.
Rutting season of the stag, i. 328, 329.

S

- Sable**, value of its skin, i. 418; its fur described, ib.; its habitudes, ib.; country, ib.; scarcity, ib.; hunted, ib.; encouragements to the hunting of, by the Russians, ib.
Sabra, the, or trachipterus, notice of the fish, ii. 286.
Safety lamp, i. 90 n.
Sagoins, a genus of monkeys, i. 486.
Sai, or the bewailer, a kind of monkey, i. 486.
Sajou, a kind of monkey, i. 486.
Saki, or fox-tailed monkey, i. 486.
Salad-oil, a cure for the viper's bite, ii. 389.
Salamander, ancient notion of the, ii. 369; its appearance, ib.; habits, ib.; whether venomous, ib.; gekko and black-water newt species, 369, 370, and n.; internal formation, 370; viviparous, ib.; produces fifty at a time, ib.; see 371 n.; amphibious, 370; changes its skin often, ib.; tenacity of life, 371 and n.; reproduction of lost parts, 371 n.; the terrestrial, where found, ib.; habitudes, ib.; darts a milky fluid from its skin, ib.; not poisonous as reported, ib.; stupidity, ib.; food, ib.; other habitudes, ib.; account of one found in a stone at Auchtertool, 371 n.
Salangana, or the nests of the Chinese swallow, composition of, ii. 154 n.; where found, ib.; valued as a delicacy, ib.; commerce in, ib.
Saline waters, their properties, i. 219 n.
Salmon, the, characterized, ii. 288; how distinguished, ib. n.; its resorts, ib.; to what seas confined, ib.; peregrinations of the, ib.; power of the, to ascend cataracts, ib.; how employed, ib. and 293.

- Salmon-fry, or parr, Mr. Shaw's investigations concerning the, ii. 288, 289 n.
- Salmon-trout, the, distinguished, ii. 290 n.; its habits, ib.; spawn, ib.; food, ib.; flesh, ib.; size, ib.; luminous in the dark, ib.
- Salt, bay and common, i. 134.
- Saltiness of the ocean, opinions concerning the, i. 132; of lakes, 133; attempts to deprive sea-water of its saltiness, ib.; advantages of the, 134; another effect of the, 135.
- Salt water, why fishes that live in it will expire in fresh, ii. 293.
- Samari monkey, i. 486.
- Sameyel, a destructive wind in Persia, i. 164 and n.
- Sanderling, account of the, ii. 191 n.
- Sand-piper, green, account of the, ii. 193.
- Sandstone (old red) system, i. 83 n.
- Sand-storm of Africa, description of the, i. 165, 166; one described by Bruce, 170 n.
- Santorin, a new island appeared at, 1707, i. 103.
- Sapajous, species of monkeys, with varieties, i. 486 n.
- Savages, their barbarous treatment of women, i. 199; their confined aims, ib.; their attention to finery and dress, 204.
- Scallop, the, remarkable for its manner of motion, ii. 336 and 335 n.; the Jacobean, its beauty described, 335 n.
- Scaup-duck, the, described, ii. 231 n.
- Scaurus Marcus, his exhibition of crocodiles to the Romans, ii. 367 and 368 n.
- Sciæna, the, fish noticed, ii. 285.
- Scolopendra of the East Indies, described, ii. 421; its painful bite, ib.; varieties, ib. and 422 n.; strength of its poison, 422 n.
- Scooper, a name of the avosetta, ii. 185.
- Scorpio, or father-lasher, a prickly-finned fish, ii. 285 n.
- Scorpion, its hideousness, ii. 418; size, 419; its parts described, ib.; its malignity in some places, ib.; effects of its sting on dogs, ib.; the, of tropical climates, 420; its irascibility, ib.; contests with the spider, ib.; with one another, ib.; kills itself, in what circumstances, ib.; female and young, ib.; food, 421; the American, ib.; the black, ib. n.; the African, ib.; strength of the scorpion's poison, 420 n.; water, an account of the, 437, 438.
- Scotchman, one in the Tower, his endurance of hunger, i. 212 and n.
- Scotland, kings of, their stag hunts, i. 345, 346 n.
- Scott, Sir Walter, history of his Highland wolf-dog, i. 400 n.
- Sea. See Ocean.
- Sea-breezes, i. 162.
- Sea-bream, a prickly-finned fish, ii. 285.
- Seal, the parts of its body described, i. 468; its size and colour, ib.; characters of the varieties, 473 n.; size of its brain, 469 and n.; Cuvier's observations on three in the French menagerie, 469 n.; tameness of one, ib.; attachment and intelligence of another, ib.; its tongue, 469; foramen ovale, ib.; habitation and food, ib.; legs, 470; a social animal, ib.; actions in fine weather and a storm, ib.; migrates, ib.; propagation of the, ib.; cry, ib.; combats, ib.; method of pursuing fish, 471; how caught by Europeans, ib.; by Greenlanders, ib.; its skin and oil, ib.; flesh, ib.; varieties of the, ib. and 473 n.; the ursine described, 473 n.; habits and affection, ib.; fights for its station, ib.; and for the female, ib.; the hooded, described, ib.; the bottle-nosed, ib.; food, ib.; gregarious habits, ib.; sluggishness, ib.; those seen by Lord Anson's people, 474 n.; their flesh, ib.; where found, ib.
- Secretion, Int. xx.
- Semnopithecus, genus of monkeys, its remarkable characters, i. 494 n.
- Senegal river in Africa, i. 124; how far navigable, ib.; inundations of, prejudicial, 126.
- Sensation, what, Int. xxiii.
- Sensations of a man newly brought into existence, described by Buffon, i. 227, 228.
- Senses of man, their comparative extent, i. 224 (see Hearing, &c.); mutual aids, 225; combination of objects of, ib.
- Seps, a venomous viper, ii. 394.
- Sepulchres, Egyptian, described, i. 250, 251; one in France described, 251.
- Serpent kind, why held in detestation, ii. 377; operation of the poison of, ib.; uses of the, ib.; where most abundant, ib.; ancient devastations wrought by some not improbable, ib. 378; harmlessness with us, 378; distinguishing marks, ib.; swallow, ib.; organs, 379; fangs, ib. and n.; internal parts, 379; number of joints in the back-bone, ib.; the ribs, 380; skin, ib.; scales, ib.; distinctions in size, ib.; size of some, ib.; torpidity after feeding, 381; tract of the, ib.; indiscriminate prey, ib.; contests for water, ib.; capability of abstinence, ib.; voices, 382; motions, ib. and n.; amphibious in fresh water only, 383; fœtor, by what possessed, 378, 383; distinguished as viviparous or oviparous, 383; as venomous or not, 384; their defence from their poisonous qualities, ib.; enemies, ib.; means to destroy and charm them, ib. and n., 385 and n.; by what nations adored, and how, 385; classification, ib.; venom, 386 and n. (see Venomous serpents); those, without venom, characteristics of, 394; their bite, 395; manner of attack, ib.; varieties, ib.
- Serpent, Sea, the, or elops, noticed, ii. 286.
- Serpent-stone, account of the, ii. 394; how it produces its effects, if any, ib.
- Sertularia, a kind of coralline insect, described, ii. 499 n.; the pen-shaped, ib.
- Serval, described, i. 376; its resemblance to the caracal, 379.
- Setters, English, described, i. 404 n.
- Sexes, state of the, in different countries, i. 199, 210.
- Shag or lesser corvorant, account of the, ii. 205 n.
- Shagreen, leather from the skin of the wild ass, i. 281.
- Shakspeare, his description of the English hound, i. 405 n.; his verses on the swallow's choice of a mansion, ii. 156 n.; his simile of the halcyon and flatterer, 237 n.
- Shape of man, i. 201; of woman, ib.
- Shark, the, ii. 267; varieties, 270 n.; the blue, described, ib.; its pouch, ib.; the basking, ib.; its oil, ib.; bone, ib.; whence the name, ib.; how taken on the Northern coasts of Scotland, ib.; its strength, ib.; use, ib.; the angel, distinguished from the common, 270 n.; the skin, how used by the Turks, ib.; where found, ib.; the great white, its voracity, 267; the, described, ib.; fins, ib.; eyes, ib.; swiftness, ib.; how it seizes its prey, ib.; depredations, ib.; instance of one biting off a man's leg, ib.; devouring persons let down into the sea, 268; of one springing at a man in a boat, ib. n.; other instances, ib.; enmity to man, 268; how taken by bait, ib.; harpooned, ib.; killed by the negroes, ib. and n.; Indians not afraid of them, 269 n.; anecdote of one, ib.; the sucking fish, or shark's pilot, 269; anecdote of its directing the shark, ib. n.; young of the, ib.; flesh, oil, ib.
- Sheath-fish, or silurus, notice of the, ii. 286.
- Sheep kind, animals of the, i. 301; characteristics of the, ib. n.; distinguished from the goat, 301 and n.; qualities and disposition of sheep, 302; their curiosity and intelligence, ib. n.; habits when tamed, 303; on the continent, follow the shepherd, ib.; comparative courage of the, 302 n.; sagacity,

- ib.; their fleece, 303; teeth, ib.; their young, 304; where found in their noblest state, ib.; different breeds of, described, 315 n.; Lincolnshire, ib.; Dorsetshire, Cheviot, ib.; Northumberland, South Down, Yorkshire, 316 n.; Scottish, ib.; size of one fed at Fenton, ib.; duny, ib.; Shetland sheep, ib.; diseases of South Down, 317 n.; effects of climate on, 304; gradation of domestication, 317 n.; different kinds of, out of Europe, Iceland, 304; African, 317 n.; Adimain, Morocco, Guinea, Congo, Zunu, ib.; Hottentot, Barbary, Corsican, described, 318 n.; Asiatic sheep, ib.; Astracan, ib.; Steatopyga, Circassian, many-horned of Iceland, ib. n.; the broad-tailed, of Tartary, &c., 304; second race of Europe, 318, 319 n.; Wallachian, Merino, 319 n.; the primitive race of, 305; different kinds of this race, 319 n.; Asiatic argali, described, ib.; the musmon, 305, 320 n.; American argali, 319 n.; bearded argali, 320 n.; anciently a wild species of the, in Britain, ib.
- Shell, the, of testaceous fishes, its substance, ii. 321; its composition, 322 n. and 327 n.; account of the formation of that of the garden snail, 322; whether formed of the slime of the animal's body, ib. and n.; colouring of the, how accounted for, 323; convolutions of the, depend entirely on the animal, ib.; collections of shells, how polished, 323, 324; pleasures of the occupation, 324; and profit, 327 n.; utility of shell-fish in supporting other animals, 325 n.; quadrupeds, 326 n.; fattening sheep, ib.; birds that eat them, ib.; shells serve as abodes to other animals, 327 n.; the teredo how it ministers to good, ib.; classification of, 324; various places where found, ib.; pelagii, or those confined to the ocean, ib.; littorales, or those cast on shore, ib.; fresh water, ib.; living land shells, ib.; fossil shells, their variety and condition, ib. 325; all the spoil of some animal, ib.; historians of this class of nature, ib.
- Shell-fish, claims to be considered as fish, ii. 305; the two tribes of, 306; crustaceous, characterized, ib.; testaceous, ib. 321.
- Shepherd's Dog, described, i. 382 and 401 n.; patience and faithfulness of the, 401 n.; hardness, 402 n.; usefulness to the shepherd, 401 n.
- Shieldrake, a kind of duck, an account of the, ii. 232 n.
- Shores, often a defence against the sea, i. 141; different appearances of, ib.
- Short-sightedness, i. 218. See Vision.
- Shoveller, ii. 181, 182. See Spoonbill.
- Shrike, name for the genus of butcher-birds, ii. 48 n.; country, form, and habitudes of the, ib.; the red-backed or lesser, ib.; the great one of America, 49 n. See Butcher-bird.
- Shrimp tribe, the, described, ii. 309 n.; where found, ib.
- Siamese, a species of the long-armed ape, account of the, i. 493 n.
- Sicily, earthquake there, in 1693, i. 99; in 1783, 102 n.
- Silk, ancient scarcity of, ii. 452; scarcity of, in the days of James I., 452 n.; manufacture of, when first introduced into this country, ib.
- Silkworm, ignorance of the ancients with respect to the, ii. 452; when first brought into Europe, ib.; the described, ib.; the two methods of breeding the, 453; in the warm climates of the East, ib.; in Europe, ib.; form, &c., of the apartment in which it is bred, ib.; provision of leaves, ib.; air, ib.; progress of the worm, ib.; its formation of the silk-cone, 454; the thread described, ib. and n.; its length, ib.; the original country of the silk-worm, 452 n.; introduced into Persia, ib.; into America, ib.; attempt to introduce it into Ireland, ib.; varieties of the insect, 454 n.; its change into the winged state, 454; male and female, ib.; eggs, ib.; method of unwinding the thread, 455.
- Silurian system, i. 83 n.
- Simoom, described, i. 165, 166, and 170 n.
- Singing-birds, their notes described, ii. 125 n.; American, 132—134 n.
- Siphunculus, a soft worm, takes possession of the shell of the strombus, ii. 327 n.
- Sirli, a kind of lark, ii. 139 n.
- Sirocco in Sicily, effects of the, i. 166 n.
- Siskins, birds of passage, ii. 148 n.; where found, ib. 149; food, ib.; song, ib.; habits, ib.
- Size of the human body, its varieties, i. 207; variations, ib.
- Skate, the, discriminated, ii. 271.
- Skin, effects of age on the human, i. 229; colour of, in different races of men, 240, 241 n.; animals that change the, ii. 443.
- Skink, a kind of stinkard, described, i. 419 and 420 n.
- Skua gull, the, ii. 211 n.
- Skull, diversities in the shape of the, i. 242 n.; classified according to the nations, ib.
- Slatberg in Iceland, disruption of the mountain of, i. 111.
- Sleep increases the weight of the body, i. 207; necessary to all animals, 210; most of all to man, 213; some animals spend much time in, ib.; effects of the want of, on man, ib.; cause of, unknown, ib.; effects of, 214; much required by the studious, ib.; a German student performed his tasks during, ib.; story of a sleep-walker, 215.
- Sleuth-hound, Scottish name for the blood-hound, i. 406 n.
- Slips of mountains, land-slips, i. 110; snow-slips, 111.
- Sloth, varieties of the, i. 530; description of the, 531; its method of scrambling on the ground, ib.; its structure and habits, ib.; whether an unfinished quadruped, ib.; a minute account of its appearance and habits in the woods of South America from Waterton, 532, 533 n.; abstinence, 531.
- Smell, Int. xxiv.
- Smelling, an inferior sense in man, i. 225; power of, possessed by some nations, ib.; uses of, ib.; the taste of different nations in respect to the objects of, ib.; sense of, possessed by birds, ii. 5.
- Smithfield, an ancient horse-market, description of the trials of horses there, i. 279 n.
- Smurstin, a favourite shell-fish with the natives of Orkney, ii. 339 n.
- Snail, the garden, its process in forming its shell described, ii. 322; organs of the, 326; horns and eyes on the two uppermost, ib.; organs of generation, ib.; coupling, ib.; eggs, ib.; growth of the shell, ib. 329; can mend its shell when broken, 329; not make a new one, ib.; method of motion, ib.; slime, ib.; appetite, ib.; killed by salt, &c., ib.; torpidity, and manner of burying itself, ib.; awakening, and voracity, ib.; one species eaten by the Romans, 329 n.; how kept, fed, and fattened, ib.; eaten in Switzerland, 330 n.; in Vienna, ib.; introduced into England, ib.; Scotland, ib.; varieties of the snail, 330; the fresh water, ib.; its peculiarities, ib.; manner of rising to the surface, ib.; viviparous, ib.; brought forth with the stony coat, ib.; sea-snails, 331; manner of impregnation, ib.; want horns, ib.; convolutions of the shell, ib.; the trochus kind, ib.; the nautilus, 332.
- Snail, the sea, whence the name, ii. 280; the, described, ib.
- Snake, the black, the largest of English serpents, described, ii. 395; not venomous, ib. and n.; manner of attack, and how repelled, ib.; prey of the, 395; oviparous, ib.; torpid in winter, ib.; uses of the, in America, ib. n.; singular experiments made on the, by Professor Luigi Metoxa, 385 n.

- Snake-catchers, in Hindostan, their exhibitions of snakes, ii. 384, 385 n.; impose on Europeans, 385 n.
- Snake-root, Virginian, the best cure for the bite of the rattlesnake, ii. 391.
- Snipe, habits of the, ii. 191 n.; adaptation of its tongue, ib.; migrations of the, ib.; flesh, ib.; the double, ib.; the little, ib.
- Snow-ball, a celebrated greyhound, account of, i. 401 n.
- Sobbing, whence it proceeds, i. 203.
- Soland goose, ii. 205. See Gannet.
- Sole, the, what remarkable in the fish, ii. 287 n.; account of the, ib.
- Solfatara, valley of, exhibits the effects of earthquakes, i. 101.
- Solon, his opinion of the beauty of the pheasant, ii. 64, 65.
- Sound, transmitted by the atmosphere, i. 155 and 158 n.; according to what laws, 158 n.; echoes of, ib.; enlarged in buildings, ib.; reflection of, ib.; how produced, 219; how rendered a tone, 219, 220; reflected, 222.
- Spalax, the, or blind rat, described, i. 451 n.; construction of the organs of sight, ib.; hearing, ib.; the spalax of the Greeks, 452 n.; lives gregariously under ground, ib.
- Spaniards, their value for asses, i. 284.
- Spaniel, the large and small water, described, i. 403 n., 383, 384; the springing, 403 n.; Alpine, 404 n.
- Sparrow kind, birds of the, their abode near man, ii. 120; why they avoid forests, 121; attachment to places, ib.; accounts of their flights and passages, ib.; arts of the bird-catcher to take them, 122; contentions of the, ib.; singing, proper to the male, ib.; the female, nest, and young, ib. 123; pairing of the, 124; chastity, described by Addison, ib.; exceptions, ib.; resemblances among the, ib.; classification, ib.; slender-billed, ib.; their food, ib.; and song, 125; thick-billed, ib.; their food, ib.; note, ib.; those of passage, ib.; their seasons of migration, ib. 126.
- Sparrow, the field, ii. 146 n.; the swamp, ib.; the tree, ib.; the song, ib.; the chipping, 147 n.
- Sparrow-hawk, account of the, ii. 45 n.; story of a tame one, ib.; his fondness for pigeons, and antipathy to an owl, ib.
- Sparus, a prickly-finned fish, ii. 285.
- Spawn of fishes, account of the, ii. 247, 248; estimate of its immense amount, 296, 297.
- Species, Int. xvi.
- Specifics, Int. xxiii.
- Spectral illusions, Int. xxxi.
- Speech, acquisition of, by infants, i. 197.
- Spermaceti, found in the head of the cachalot, ii. 261; how distributed there, ib.; uses of, ib.; how the whole oil of the fish convertible into, ib.
- Spider, the, described, ii. 406 and n.; habits of the venatores at Rome, 409 n.; discipline, ib.; nest of the house spider, 407 n.; the Martinico, 406; of one that carries air to breathe under water, 411 n.; the body of the spider described, 406; its web described, 407; its power of renewing the web, 408; contests of the, ib. and n.; eats its own claws when deprived of other food, ib.; the garden spider and its nest, 408; spiders counterfeit death, in what circumstances, ib. n.; power of making aerial voyages, ib. and 409 n.; method of seizing prey, 409; copulation of the, ib.; female, eggs and young, 410; webs spun into thread, ib.; varieties, ib.; the gossamer described, ib. n.; the water, 410, 411; the bird-catching, 411 n.; the banded, ib.; the tarantula, 411, 412.
- Spinous fishes, how distinguished by their gills, ii. 283; numerous species, ib.; systems, ib.; Artdi's, ib.; Linnæus's, ib.; Gouan's, 284; particulars of, with descriptions, 284—292 and n.; uniformity of their description, 292; their bones, ib.; proportion of, to the fins, 293; live but a short time out of water, ib.; exceptions, ib.; passage of some from salt to fresh water, ib.; some from fresh towards salt to spawn, 293, 294; fishes of passage, 294; the cod, ib.; haddock and mackerel, ib. and 301 n.; herring, 295, 296 and 303 n.; pilchard, 296; their immense numbers, ib.; their numbers in the Indian ocean, ib.; whether they come from the egg perfectly formed, 297; white bait, ib.; impregnation, ib.; growth, ib.; live on one another, 298; the dorado, ib.; warfare in fresh water, ib.; diffidence of fresh-water fish, 299; voracity of the pike, torpidity in winter, ib.; diseases, ib.; poisonous qualities of some, ib.; how caused, 300.
- Sponge, the, of the polypus class, account of the, ii. 499 n.; the funnel, ib.
- Spoonbill, the, described, ii. 181; country of the, 182 n.; the European, 182; the American, ib.; fine colour and uncouth shape, ib.; habits, 182 and n.; food, ib.; nest and young, ib.; the white, described, ib. n.; the roseate, ib.
- Spouts, water, one in the Mediterranean described by Tournefort, i. 176; their origin, 177; dreaded by mariners, ib.
- Springbok, a kind of antelope, i. 322 n.; migrations of the, in immense herds, 323 n.
- Spring-water, i. 113; hot, account of, 119 n.; at Bath, ib.; at St. Miguel, ib.
- Squash, a kind of stinkard, described, i. 419.
- Squilla, the, described, ii. 309 n.; where found, ib.
- Squirrel, an idea of its form, i. 431; the tail and its uses, ib.; varieties of the, ib.; the common described, ib.; the grey Virginian, 432; the Barbary, ib.; the Siberian white, ib.; Carolina black, ib.; Brazilian, ib.; that of New Spain, ib.; its extensive diffusion, ib.; the varieties differ in disposition and food, ib.; the common, characteristics of the, ib.; agility, ib.; food, ib.; its nest described, ib.; provisions of nuts, 433; propagation of the, ib.; watchfulness, ib.; its nimbleness, ib.; abode on trees, ib.; migrations of the, in Lapland, ib.; method of crossing lakes there, ib.; domesticated, ib. and n.; the flying, its class, 434; different species of the, ib. n.; European flying, where found, ib.; its habits, ib.; female's care of the young, ib.; description of the, and its nature, 434; its amazing spring, ib.; how adapted for it, ib.; where found, ib.; tamed, ib.
- Stag, described, i. 326; its horns, 327; the rutting season of the, 328, 329; size, colour and habits, 329; capable of being tamed, 329 n.; hunting of the, 330 and 345—347 n.; laws concerning the, 330; description of a dangerous stag-hunt, 346 n.; description of stag-hunting in England, 331, 332; hunted in Sicily, 333; in China, ib.; the Chinese stag described, ib.; Corsican, ib.; that of Germany, ib.; that of Sardinia, ib.; Asiatic described, ib. n.; the American, 334; the Russian, ib. n.
- Stagnant water, i. 113; how purified, ib. n.
- Stare, or starling, its description, ii. 127 and 130 n.; voice, ib.; migration, and peculiar flight, 127; abodes, 130 n.; the red-winged of America, where found, ib.; habits, 131 n.; flocks of the, and their enemies, ib.; retreats, ib.; benefit from, in destroying grub worms, calculated, ib. 132 n.; peculiar note, ib.; difference of size between male and female, ib.
- Stars, fixed, i. 60, 64 n.; falling, what, 176; why their causes not ascertained, ib. n.
- Star-fish, the, described, ii. 491; (see n.); hard substances found in its stomach, ib.; increases in size, ib.; properties, ib.; parts of the body described, ib. and n.; the hairy, 492 n.
- Statues, ancient models of beauty, i. 207.

- Stature of the body, how affected, i. 238; varieties of, in different nations, 238 n.; of men not diminished, 247, 248.
- Stewart, Dugald, his account of a boy born blind and deaf, i. 223, 224.
- Stickleback, the, or gasterosteus, described, ii. 286; account of the fifteen-spined, or great, ib. n.; habits, ib.; migrations of the, 296.
- Stinkard, foetid smell of the, i. 419; varieties of the, ib.; the squash, skink, &c., ib.; their foetid glands described, 420; uses of this odour to the animal, ib.; strength and offensive nature of it, when the animal is enraged, ib.; an instance of this by Kalm, ib.; kept tame by the Americans, 421.
- Stoat, when the ermine properly so called, i. 413; see Ermine.
- Stock-dove, the original of the pigeon, ii. 112; described, ib.; young, 113.
- Stomach, Int. xli; of quadrupeds, i. 262.
- Stones, precious, whence their value, i. 205.
- Stork, its resemblance to the crane, ii. 168; distinctions in appearance, ib.; and manners, ib.; characteristics of the species, 169 n.; regular migrations and manner of, 169 n., 170 n., 168; food of the, 168; affection for the young, 170 n., 168; story of its affection, 170 n.; respected by the Egyptians, ib. 168; by other nations, 170 n.; friendly feeling towards men, 170 n., 168; the white, 170 n.; the black, described, 171 n.; its migrations, ib.; a secluded animal, ib.; voice, ib.
- Storms, Colonel Reid's theory of, i. 165 n.
- Strabism of the eyes, what, i. 218.
- Strata, arrangement of, i. 83, 84 n.
- Strength of man, i. 208, 209; some remarkable instances of the, 209.
- Strepsicheros, breed of sheep, described, i. 319 n.
- Stromateus, a soft-finned fish, ii. 287.
- Stunt, the whale at two years of age, ii. 254.
- Sturgeon, its disposition, ii. 277; description, ib.; different kinds and different uses of each, ib.; visits all the seas of Europe, 278; size of one taken in the Esk, ib.; where most abundant, ib.; how caught, ib.; temperate and timid, ib.; preserved, ib.; trade with the roe, 279; isinglass, ib.
- Sucking-fish, the, or echineis, ii. 287.
- Sukotyro, a new genus, described, i. 514 n.; its shape, tusks, food, ib.
- Sulphureous waters, their properties, i. 118 n.
- Suns, mock, or reflected, seen in the polar regions, i. 175.
- Sun-fish, its size and appearance, described, ii. 279.
- Surf of the sea, its dangerous nature, i. 141.
- Surinam toad, account of the, ii. 358, 359; see Pipal; serpent, its beauty, 396; considered fortunate by the savages there, ib.
- Surmolot, or great brown rat, described, i. 441 and n.; see Rat.
- Surmulet, notice of the fish, ii. 285.
- Swallow, its migration, ii. 12 and n.; peculiarities and varieties of the, 153; characteristics of the, ib.; food, ib.; agility, ib.; tail, ib.; its appearance in spring, ib. and 155 n.; nests of the various kinds of the, 153, 154; in China, 154; choice of situation, 156 n.; how to discard them, ib.; partiality of the Americans to, ib.; nests in barns, ib.; chimneys, ib.; windows, 157 n.; eggs and young, 155; assembling of the, ib.; migration, ib.; seen at sea, ib.; whether all migrate, ib.; the window, nests of the, 157 n.; disliked by some, 156 n.; the chimney, 157 n.; the swift, ib.; the nocturnal or goat sucker, 158 n.; nests of the Chinese in what estimation held as a delicacy, 154 and n.; in what places found, 154, 155 n.; popular errors regarding the torpidity of, 160 n.; at what price sold, ib.
- Swallow, sea, a kind of gull, ii. 207 and 212 n.
- Swallows of Ternate, a name of the bird of paradise, ii. 102.
- Swammerdam, his persevering inquiries into the nature of shell-fish and insects, ii. 325.
- Swan, the, its characters, ii. 221 n.; food, ib.; its awkward motions on land, 219; beautiful and graceful on the water, ib.; the wild and tame distinguished, 221 n. 222 n. and 219; the wild migratory, 221 n.; gentleness of the, ib.; formidable from its strength, ib.; the wild, where found, ib.; its habits, 222 n.; early migrations, ib.; how haunted at Kamtschatka, ib.; an intermediate species between the wild and tame described, ib.; the black, where found, ib.; scarcely a rarity, ib.; an account of it, ib.; whether the swan sings, 220; relations on the subject, ib.; food of the, ib. and 221 n.; incubation and young, 220; formerly esteemed for the flesh, 221; where now preserved for their beauty, ib.
- Swift, a kind of swallow, its distinctions and habits, ii. 157, 158 n. and 153.
- Swimmers, an order of birds, characteristics of, ii. 199 n.
- Sword-fish, its attacks on the whale described, ii. 254; the, described, 284; strength, ib. n.; two species, ib.; instance of the, sending its snout through the sheathing and seven inches of the planking of a ship, ib.
- Syagush, name of the caracal, i. 376, 379; see Caracal.
- Symmetry of living forms, Int. xliii.
- Syria, animals of, the softness of their hair, i. 360.
- Systems of natural history, Int. xi; i. 58; method of using, 253; advantages of, ib.; defects of, ib.; Ray's, 254; Klein's, ib.; Linnaeus', 255; that followed in this work, 255-257.

T

- Tadpole, the spawn of the frog on the forty-first day, ii. 348, 349 and n.; its metamorphosis considered, 349 n.
- Tajacu, i. 352. See Peccary.
- Talapoin, a monkey, fine colours of the, i. 485.
- Talbot or English hound, described, i. 405 n.
- Tamain, kind of monkey, i. 486.
- Tamandua, larger and smaller species of the anteater, i. 529.
- Tanager, scarlet, its note, ii. 134 n.
- Tanree, distinguished from the hedgehog, i. 454; described, ib.; habitudes, ib.
- Tape worms, whether they always produce disease, ii. 490 n.; the common tape, described, 491 n.
- Tapestry bee, her ornamental furnishing of the interior of her cells, ii. 464 n. See Poppy-bee.
- Tapeti, or Brazilian rabbit, an account of the, i. 438.
- Tapir, the hippopotamus of the new continent, i. 528; described, ib.; its food, ib.; flesh, ib.; characteristics, ib. n.; habits, ib.; attitude, ib.; account of a female one exhibited at fairs in Holland, ib.
- Tarantula, bite of, said to be cured by music, i. 221; a kind of spider, described, ii. 411; its fabled dangerous bite and cure by music, 412; method of catching it, ib. n.
- Tarnassar, the great bird of, supposed to be the condor, ii. 34.
- Tartar race of men described, i. 234.
- Taste, Int. xxiv.
- Tasting, opinions concerning the sense of, i. 226; sensible in children, ib.; affected by habit, ib.
- Tatou, see Armadillo, i. 458; apara, 459; of Ray, ib.; tatuette, ib.
- Tazee, a breed of Indian horses, i. 274 n.
- Teeth, variety of, in animals, i. 205; of quadrupeds, 261; of the cow, 289.
- Tehama, country of, increase of, i. 142 n.

- Telescope-fish, the properties of the, ii. 282, 283 n.
 Temperate regions, earth in the, i. 67.
 Tench, the fish, described, ii. 291 n.; its resorts, ib.; size, ib.; flavour, ib.; account of one that took the shape of a hole in which it was confined, ib.
 Tendrac, the, distinguished from the hedgehog, i. 454; size, movements, and habits, ib.
 Tendons, Int. xxvi.
 Teneriffe, peak of, volcano, i. 94; its height, 109.
 Teniae, or tape worms, account of the, ii. 490 n.
 Tercerons, who, i. 241 n.
 Teredo bores through wood and stone, ii. 327 n.; breaks down sand banks, ib.
 Termes, or death-watch, described, ii. 483 n.; manner of producing sound, ib.
 Termites, or white ants, where found, ii. 473 n.; their classes in society, 474 n.; buildings, ib.; internal arrangement, ib.; immense size of their queen, 475 n.
 Tern, the, or sea swallow, an account of the, ii. 212 n.
 Ternate, how rendered unwholesome, i. 153.
 Terriers, Scotch and English, described, i. 405 n.; bull, 406 n.
 Tertiary formations, i. 83 n.
 Tetradon, the lineated, described, ii. 282 n.; the remarkable power of the fish to inflate its body, ib.
 Teuthys; the fish described, ii. 286.
 Theatres and concert rooms, how they should enlarge sound, i. 158 n.
 Therasia, a new island, i. 103.
 Thermometer, i. 115; principle of the, ib.; different kinds of the, 119 n.; limits of the, ib.
 Thoracic fish, what, ii. 284; prickly-finned, 285; soft-finned, 287.
 Thornbacked-ray, distinguished, ii. 271.
 Thrush kind, birds of the, ii. 126 and 127 n.; their properties, 126; varieties, the missel thrush, its size and distinctions, 127 n.; the song thrush, 128 n. See Mavis; other varieties, 127; the fieldfare, blackbird, &c., see Fieldfare, Blackbird; American thrushes, 132 n.; the brown or thrasher, ib.; its notes, ib.; the migratory or red-breasted, ib.; the wood, its haunts and song, described, ib.
 Thumb-footed shell-fish, account of the, ii. 342.
 Thunny, account of the, ii. 302 n.; of the fisheries of the, ib.
 Thyroid cartilage, seen in men, i. 205.
 Tides of the ocean, i. 136; description of the, ib.; precise account of the manner in which they are caused, 136, 137; affected by the channel of the sea, 137, 138; the greatest, where, 138; an effect of the, ib.
 Tiger, the, its beauty, i. 367; fierceness, ib.; distinctions of the, ib.; relative position, ib.; where found, 368; habits, ib.; strength, ib.; combat of one with three elephants, ib.; the three kinds of the, in Sundah Rajah's dominions, 369; scarceness of the real species, ib.; the Bengal tiger, described, 369 n.; fight between two tigers and a lion in the Tower of London, described, 367, 368 n.; tiger of Sumatra, its destructiveness, 371 n.; how taken, ib.; how far tameable, 367 and 371 n.; playfulness of one, 371 n.; tigress and her young, 370 and 372 n.; affection of one for a terrier, 371 n.; recognition of a ship-carpenter by one, 372 n.; of a sailor by another, ib.; affection of one for a bitch, ib.; their skins, 370 and 372 n.; reproduction in menageries, 373 n.; varieties of the species described, 370 and 373 n.
 Tinea, the family of moths, ii. 447 and n.; to what substances destructive, 448 n.; ancient methods of defending against them, ib.; what substances kill them, ib.; the eggs, how deposited, ib.; domicile, how constructed, ib.
 Tipula, the, often mistaken for the gnat, ii. 483
 484; its harmlessness, 484; water, a kind of insect, an account of the, 437.
 Titling, the winter fauvette, why so called, ii. 142 n.
 Titmouse, the crested, its note, ii. 134 n.; character and habits of the, 139 n.; fecundity, ib.; where dispersed, ib.; snaring of the, ib.
 Toad, the, distinguished from the frog, ii. 354; hideous to the imagination, ib.; resemblance to the frog, ib.; propagation and assistance of the male, ib.; food, ib.; account of the habits of one tamed by Arscott, ib. 355; instance of the Germans eating the, without injury, ib.; another instance of its wholesomeness, ib.; its utility, 355, 356 n.; fables concerning the, 356; its real character, ib.; torpidity in winter, ib.; account of several instances of its being found in the heart of trees and stones, ib.; experiment proving their possibility, 357 n.; account of their sucking cancerous sores, 357; varieties, the water, 358; the pipal or Surinam, ib. 359; the horned, 358 n.
 Tococo, the flamingo, why so called by the natives of Canada, ii. 184.
 Tones, how produced, i. 219; their succession in proportion make music, 220.
 Tonquin, extraordinary tides there, i. 138; how accounted for, ib.
 Tornado, description of the, i. 165.
 Torpedo, a kind of ray, described, ii. 274; its electrical shock described by Kempfer, ib.; causes ascribed for the effect, 275; its power declines with its vigour, ib.; where the power resides, ib.; experiment proving the shock electrical, 275, 276 n.; other fishes possessed of the same power, 275.
 Tortoise, its superiority to the fish tribe, ii. 314; why ranked among them, ib.; land and water, ib.; difference between the, and the turtle, ib.; habits of the, ib.; shell, ib.; the body described, ib.; varieties, ib. n.; internal structure, ib.; its organs described, 315; White's account of one, showing its habits, docility, &c., 320 n.; difficult to be killed, lives with the brains out and the head off, 315; longevity of the, ib.; of one in Lambeth palace, 321 n.; one at Peterborough, 220 years old, account of its habits, ib.; food of the, 315 and 320 n.; motion of its blood, 315; dormant state, 316 and 325 n.; slowness of all the actions, and changes of the, 316; eggs, ib.; nest, ib.; shell, composed of several pieces, ib.; habitudes, ib. Sea-Tortoise, see Turtle.
 Touan, or short-tailed opossum, its parts described, i. 497 n.
 Toucan, a bird, whether attracted to carrion by the sight or smell, ii. 37 n.; account of its extraordinary conformation, 91; of the red-beaked, ib.; food or prey, 91 and n.; tongue of the, and its use, 91; how it protects its young, ib.
 Touch, sense of, corrects sight, i. 217; its utility, 226; widely diffused, ib.; affected by habit, ib.; where chiefly seated, ib.; importance of, ib.
 Trachinus or weever, a kind of fish, described, ii. 285; pain of the sting of its back fin, 299.
 Trachipterus, or sabre, the fish, noticed, ii. 286.
 Trade-winds, i. 160; in the Atlantic, 161; of Nova Zembla, &c., ib.; theory of, 166—169 n.
 Trägelaphus, the stag of Germany, i. 333.
 Transformation of insects, ii. 405 and 404 n.
 Tree wasp, account of the, ii. 466 n. See Wasp.
 Tree-hoppers, the ancient cicada, their instrument of sound, ii. 429; habitudes, 430 n.; eggs, and grubs, ib.
 Trembley, the discoverer of the reproduction of zoophytes from cutting, ii. 490; his classification of the polypus, 493.
 Trichurus, a prickly-finned fish, ii. 284.
 Trigla, properties of the fish, ii. 285.
 Triton, reproduction of its amputated limb, ii. 308 n.
 Trochus, a peculiar kind of snail without mouth, ii.

- 331; preys on other snails, *ib.*; all sea-snails liable to its attacks, *ib.*
Troglodyte described, i. 475 and *n.*; its habitation, 475 *n.*; account of two, *ib.*
Trojan method of dressing a swine at Rome, i. 351 *n.*
Tropics, constancy of winds there, in certain seas, i. 160; hurricanes at the, 163; atmospheric phenomena of the, 173, 174.
Trout, the, described, ii. 289 *n.* and 290 *n.*; season of spawning, 290 *n.*; resorts of the, *ib.*; in winter and summer, *ib.*; varieties, *ib.*
Trunk of the elephant, account of the, i. 499 and *n.*
Tumble-dung, a kind of beetle, described, ii. 478; its sense of smelling, *ib.*; kings of the class, *ib.*
Tumbler, a kind of dog, described, i. 406 *n.*, 383.
Tupinambis of Congo and New Holland, described, ii. 369 *n.* See *Monitor*.
Turbinated shell-fish, ii. 324, 328.
Turbot, the, described, ii. 287 *n.*; where found, *ib.*; how fished off Yorkshire, *ib.*
Turk, White, name of a celebrated horse, i. 280 *n.*
Turkey, its original country, ii. 61; the American wild, *ib.*; habits in the wild state, *ib.*; how hunted, 62; habits, animosities, and antipathies of the tame, *ib.*; cowardice, *ib.*; female and young, *ib.*; screams and agitation of the female when the young attacked, *ib.*; the wild turkey described, 62 *n.*; their flocks, *ib.*; rearing of young, 63 *n.*
Turkey month, why September so called by the natives of North America, ii. 63 *n.*
Turnspit, a kind of dog, described, i. 407, 408 *n.*
Turnstone, the bird described, ii. 193 *n.*
Turtle, the, whence its difference from the tortoise arises, ii. 314; the, described, 317; the great Mediterranean, or coriaceous, its great size and uselessness, *ib.*; poisonous, *ib.*; account of one of this species, *ib.*; of one caught near Scarborough, *ib.*; those of the Indian ocean, the trunk, *ib.*; the loggerhead described, *ib.* and *n.*; where found, *ib.* *n.*; boldness and strength of it, *ib.*; food, *ib.*; hawkbill or imbricated, 317; the green, its estimation, 318 and *n.*; wholesomeness, *ib.* *n.*; case in which pernicious, *ib.*; kept in Jamaica in parks, for the London market, *ib.*; how kept on board ship, *ib.*; qualities of the, as food, 318; why called the green turtle, *ib.*; its size, *ib.*; where most numerous, 319; comes from the sea to fresh water, and to deposit its eggs, *ib.*; breeding, *ib.*; eggs, *ib.*; hatched by the sun, *ib.*; how taken, 320; harpooned, *ib.*; how taken by divers, *ib.*
Turtle-dove, its fidelity, ii. 113; four notes in the woods described, *ib.* *n.*; the bird described, 115; a bird of passage, *ib.*; nests and food, *ib.*
Turtle eaters, a people of Ethiopia, described by Diodorus Siculus, ii. 318.
Tusks of the hog kind, their connexion with their vengery, i. 356; of the elephant, 500; weight, 510 *n.*; trade in the, 509, 510 *n.*
Typhons or water-spouts, seen at land, i. 177; description of one at Hatfield, 1687, *ib.*; conjectures concerning, *ib.*
- U
- Unan*, a kind of sloth, i. 530.
Unicorn, whence the origin of the stories concerning it, ii. 260; the sea, or narwhal, described, 259.
Universe, sketch of the, i. 59.
Univalve, or turbinated shell-fish, ii. 324.
Uranoscopus, the fish, described, ii. 285.
Urchin, Sea, the proper class of the, ii. 341 *n.*; the, described, 341; its horns and spines, *ib.*; its swiftness notwithstanding its many spines, 342; what sort of food it is, *ib.*
Urson, distinguished from the porcupine, and described, i. 456.
- Urus*, white, a breed of the wild ox, i. 291 *n.*; described, *ib.*; those at Burton Constable, *ib.*; scarceness of the, *ib.*; the, or wild bull, where found, 290; described, 291; name transferred to the bison, 296 *n.*
- V
- Vampyre*, the American, described, i. 462; blood-sucker, *ib.*; Ulloa's report on this subject confirmed, *ib.*; by the construction of the tongue, *ib.* *n.*
Vansire, a kind of ferret from Madagascar, described, i. 415.
Vapours, noxious in mines, i. 87, 88 (see *Gas*); inflammable, in Persia, 89.
Vari, a kind of monkey, i. 487.
Varieties, *Int.* xvi.
Vegetables, their analogies to animals, i. 183; most, useful, 185; few noxious, *ib.*
Venom of the serpent, the bag of, described, ii. 386, 387; appearance of, through a microscope, 387; taste of, *ib.*; has been drunk without producing a bad effect, *ib.*; Lucan's observation of this, *ib.*; how fatal introduced into the circulation, 388; experiment showing the potency of, *ib.*; doubts, *ib.*
Venomous serpents, their anatomical characters, ii. 386 *n.*; seat of the venom, in the animals, 386; venomous apparatus, *ib.* *n.*; fangs, 386; character and position of the, in different serpents, *ib.* *n.*; teeth, 386; venomous bag, 387; the fangs and the operation of wounding, *ib.*; appearances and effects caused by the wound, *ib.*; the venom, *ib.*; habits, 388; food, *ib.*; manner of the attack, *ib.*
Vertebrata, *Int.* xxxvi, xlvii; analogy among, *ib.*; xlv.
Vesuvius, volcano of Mount, i. 92—94; its connexion with *Ætna* and *Stromboli*, i. 96 *n.*
Violet carpenter-bee, her excavations into wood for a nest, described, ii. 462 *n.*; teeth, *ib.*; eggs and young, *ib.*
Viper, the class discriminated, ii. 386 *n.*; manner of its motion, 382, 383; the, of Great Britain, 388; resorts, *ib.*; properties, *ib.*; eggs, 389; abstinence, *ib.*; food, *ib.* and *n.*; torpidity during the winter, 389; how taken, *ib.*; salad-oil a cure for its bite, experiment showing this, *ib.*; the method of cure prescribed by Celsus, *ib.* *n.*; the viper widely diffused, *ib.*; with difficulty destroyed, 390 *n.*; flesh said to be medicinal, 390.
Vision, errors in, i. 216, 217; does not give us an idea of distance without the aid of touch, 217; experiment on this subject, 217, 218; near-sightedness of, 218; at different ages, *ib.*; rendered indistinct by excessive brightness of the object, *ib.*; why, 219.
Vital principle, *Int.* xxxviii.
Voices of birds, observations on the, ii. 6; of the various singing birds, described, 125 *n.*; of American singing birds, 132—134 *n.*
Volcanoes, i. 91; their cause, 92; volcanic zone, 95 *n.*
Vorticellæ, wheel animals of the polypus kind, ii. 499 *n.*
Vulture, its relative position among birds, ii. 36; distinctive qualities, 37; account of the appearance and habits of the, 39 *n.*; sense of smell or sight, *ib.* *n.* and 37 *n.*; climate, 37; varieties, the golden particularized, 37, 38; parts of the animal, 37; service of, in Egypt, *ib.*; habits there, *ib.*; in America, *ib.*; skill in tearing a body to pieces and manner of feeding, *ib.* 38; sloth and voracity, 38; hostility to the crocodile, *ib.*; nests, *ib.*; the king of the vultures, described, *ib.*; account of one by Bruce, 39 *n.*; percnopterus, carrion-eater i. 410 *n.*; their acuteness of vision, *ib.*

W

- Wadan, a kind of buffalo, i. 299 n.
- Wagtails, classification of, ii. 142 n.; habits, ib.; flocks, ib.; migrations, ib.; gaiety, ib.; nest and young, ib.; British species, 143 n.; the gray, ib.; the yellow, 144 n.; the pied, ib.
- Walfishes, the Icelandic name for the food of the whale, ii. 354.
- Wall-bees, ii. 463. See Bee.
- Walrus fossil, i. 511 n.
- Wanderow, a kind of baboon, an account of the, i. 481 and n.
- Wapiti, the stag of North America, described, i. 334 n.
- Warbler, characteristics of the, ii. 141 n.; the palm, ib.; the blue-mountain, ib.; the hemlock, ib.; the pensile, ib.; the superb, ib.
- Warine, a Brazilian monkey, i. 486.
- Washington, bird of, a species of sea eagle, its flight described, ii. 31 n.
- Wasp, very different from the bee, ii. 464; the, described, ib.; voracity and fierceness, ib.; distinctions of the communities of the, ib.; account of the formation of its nest, ib.; materials, ib.; dome, 465; comb, ib.; pillars and stories, ib.; cell, ib.; worms and their processes, ib.; formidable to other insects and voracious, 466; effects of winter on the, ib.; the solitary wasp, 467; its apartment, ib.; egg, ib.; provisions, ib.; death, ib.; emerging of the young, ib.; account of the wasp of the West Indies, ib.; of the vespa Britannica, or tree-wasp, 466 n.; is a paper-maker, 464 n.
- Water, i. 112; its penetrating nature, ib.; its subservience to vegetation, ib.; its composition, 113 n.; rain-water, 113; spring-water, ib.; river-water, ib.; stagnant, ib.; sea-water, ib.; mineral and medicinal, 114, and 118 n.; impurities in, 114; operation of cold and heat on water, 114, 115; compression of, 115; fluidity, 116; science of, or hydrostatics, ib.; paradoxes in, 116—118; its ascent in fine glass tubes, 118; cause of, ib. n.; compressibility of, 119 n.; evaporation of, 120, and 127 n.; vapour a component part of air, 157 n.
- Water-fly, an account of the, ii. 437.
- Water-fowl, characteristics of, ii. 197; toes, 198; legs and feathers, ib.; oil and skin, ib.; classification of, ib.
- Water-hen, the, distinguished from the coot, ii. 193; the bird described, ib. and 195 n., 194; its habits, ib.
- Waterton, his account of the habits of the sloth, i. 532, 533 n.; his account of his jumping on the back of a crocodile confirmed by many other instances, ii. 365 n.
- Waving line of beauty, Darwin's theory concerning our ideas of, i. 206 n.
- Wax, how collected by the bee, ii. 456; the two kinds of, 461 and n.
- Wealden formation, i. 83 n.
- Weasel kind, animals of the, their characteristics, i. 412; fur, ib. 418; their odoriferous glands, 412; habits and shape, ib.; size, ib.
- Weasel, its size and proportions, i. 412; description of the, ib.; its noxious nature and habits, 412, 413; history of one tamed by Mademoiselle de Laistre, 425 n.; how tamed, ib.; account of one destroying an eagle, ib.; in the same way destroying grouse, 426 n.; method of stealing and eating its prey, 413; parturition of the, ib.; effluvia, ib.; affection for putrefaction, and instance of, ib.
- Weaver fish, ii. 299; see Trachinus.
- Web of the spider, how formed, ii. 407, 408; of the garden-spider, 408; of the hunter-spider, 409 n.; spun into thread, 410.
- Werner, his theory of the earth, i. 72 n.; classification of rocks, 72, 73 n.
- Whale, its greatest size, ii. 251; its amazing appearance, ib.; seven varieties of the, ib.; the great Greenland, described, ib. 252; its skin, 252; tail, ib.; scarfskin, real skin, blubber, ib.; cleft of its mouth, ib.; whalebone, ib. n.; eyes, 252; ears, ib.; spouts or nostrils, ib.; its internal structure, ib.; fidelity, 253 and n.; female and young, ib. and n., 254; gregarious, 254; food of the, ib.; inoffensiveness, ib.; its enemies, ib.; nations that fish them, 255; whales diminishing in numbers, and the effect, 255 and n.; the, how killed by the Biscayneers, 255, 256; account of the northern whale-fishery, 256, 257; whale fishing in the South seas, 257, 258 n.; uses of the oil and greaves, 256; barb and flesh, ib.; whalebone, 252 n.; flesh, by what nations prized, 256.
- Whalebone, account of its position and consistency, ii. 252 n.
- Whale-louse, its injury to the whale, ii. 254.
- Wheel animals of the polypus kind, account of, ii. 499 n.
- Whelk, its class, ii. 339 n.; food from the, ib.
- Whidah-bunting, account of its change of plumage, ii. 151 n.; see Widow-birds; where found, 152 n.
- Whimbrel, account of the bird, ii. 193 n.
- Whip-snake, its appearance, ii. 393; venomous bite, ib.
- Whirlpools; see Currents; the Maelstrom, &c., i. 140.
- Whiskers, veneration of the Spaniards and other nations for, i. 204.
- Whiston, his theory of the earth, i. 70, 71.
- White bait, account of the appearance of, near London, ii. 298; what they are, 304 n.; how taken, ib.; described, 305 n.
- Whiting, the, noticed, ii. 287 n.
- Whitling, the young of the salmon trout, not of the salmon, ii. 290 n.
- Widah, kingdom of, the serpent, how adored there, ii. 385.
- Widow-birds, whence the name, ii. 151 n.; the females, and young described, ib.; change of plumage, ib.; account of the moulting of, and of the Whidah-bunting, ib.
- William the Conqueror, an improver of horses, i. 278 n.
- Wilson's account of the pinnated grouse, ii. 73 n.; of the crow, 84, 85 n.; of the woodpecker, 195—199 n.; account of the wild-pigeon of America, 117—119 n.
- Winds, i. 159; how produced, ib.; chiefly by the sun, ib.; difficulty of a history of, ib.; steadiness of, in certain places, 160; causes of, ib.; trade-winds, 161, and 166—169 n.; monsoons, 161 and 169 n.; some winds peculiar to certain coasts, 161; some change daily, 162; east, why the most powerful and constant, ib.; on mountains, ib.; varied by the seasons, 162, 163; table of their different velocities, 163 n.; its current, how increased, 163; hot, ib.; destructive, ib.; in Persia, 164; hurricane, ib.; tornado, 165; sand-storm, ib.; storms in France, 166; sirocco, ib.
- Wind-gun, account of the, i. 149.
- Wings of birds, their conformation, ii. 4; power, 5 n.; use of, in diving-fowls, 217 n.
- Wing-shell, or pinna, stockings made of its beard at Palermo, ii. 334 n.; the prickly, ib.; the giant, ib.
- Wire-worm, a kind of grub, its injuries to seed, ii. 477 n.; how prevented, ib.
- Wistiti, kind of monkey, i. 486.
- Wolf, the, distinguished from the dog, i. 387; period of gestation, ib. and n.; size, colour, and disposition, 387, 388; antipathy to the dog, 388; their untameableness, ib.; their generation, 389; strength, ib.; suspiciousness, 390; how hunted, ib.; how extirpated from England, ib. and n.; where found, 391; the North American, its tractability, ib.; anecdotes concerning it, 408 n.; their cunning, ib.

- how frightened, *ib.*; and taken, *ib.*; its madness, *ib.*; preservation of its young, 409 n.
- Wolf-fish, notice of the, ii. 286.
- Volga, the largest river in Europe, i. 122, 123.
- Wolverene, variety of the glutton, i. 423 n.
- Woodcock, size and description, ii. 69; haunts, *ib.*; in winter, *ib.*; in the forests, 70; habits in spring, *ib.*; its cry then, *ib.*; female and young, *ib.*; migrations of the, 190 n.; nests, *ib.*; account of their migration, and proof that the season of, depends on the state of the atmosphere, *ib.*
- Woodpecker, characteristics of the, ii. 93; colonies of the, *ib.*; green woodspite described, *ib.*; tongue and its use, 94, and 99 n.; description of the apparatus by which the tongue is extended, 99, 100 n.; how it attacks ant-hills, 94; its nest, *ib.*; young, *ib.*; hanging nests of the, in Guinea and Brazil, 95; the, of America, described, the ivory-billed, 95, 96 n.; industry in clearing trees of vermin, *ib.*; its remarkable cry, *ib.*; the gold-winged, account of the confinement of one, 96 n.; the red-headed, 96, 97 n.; devours great quantities of insects, 97 n.; the downy, *ib.*; its nest, *ib.*; industry in perforating trees, 98, 99 n.
- Woodspite, green, ii. 93; see Woodpecker.
- Woodward, his theory of the earth, i. 69; of earthquakes, 98.
- Wool, manufacture of, when commenced in Britain, i. 303; quantity exported in the reign of Edward III., 315 n.; of the Cheviot sheep, in demand, *ib.*; excellence of Shetland sheep, 316 n.; that of Merino sheep described, 319 n.
- Worms, their motion, how affected by the spiral muscle, ii. 489; what organs they want, *ib.*; eggs, *ib.*; young, *ib.*; avoid the animals that prey on them, *ib.*; what peculiar in them, *ib.*; reproduction by cutting, when first observed, 490; two made out of one, *ib.*; the hair-worm, its appearance, *ib.* n.; the Guinea, *ib.*; injuries to man from the, *ib.*; the fury, its bite, *ib.*; the naked tube-worm, *ib.*; tape-worms, *ib.* and 491 n.
- Wow-wow, or ash-coloured gibbon, i. 493 n.
- Wrasse, a prickly-finned fish, ii. 285.
- Wren, described, ii. 139 n.; the winter, *ib.*; the house, 140 n.; the common, *ib.*; fable of the eagle and the, *ib.*; the marsh, 134 n.; the house, *ib.*
- Wryneck, resembles the woodpecker, ii. 94 n.
- Wynkyn de Worde, account of the cat published by, i. 360 n.; his qualifications of a good greyhound, 401 n.

X

Xiphias, ii. 284; see Sword-fish.

Y

Yak, a species of bison, i. 297 n.; described, i. habits, *ib.*; country, *ib.*; use of the, in different countries, *ib.*

Yawning, how produced, i. 203; its sympathetic, *ib.*

Yellow-throat, Maryland, its note, ii. 134 n.

Young, courage and art of animals in defending the, i. 266, 267.

Youth; see Puberty.

Z

Zambos, who they are, i. 241.

Zebra, its beauty and untameableness, i. 284; different kinds of the, 284 n. and 286 n.; original country of the, 284; its shape and colours, 284, 285; male described, 285; instances of its fierceness, *ib.*; reason why untamed, *ib.*; swiftness of the, 286; its food, *ib.*; voice, *ib.*; value, *ib.*; of the plain, different from the common, 287 n.; its description, *ib.*

Zeiran, a kind of gazelle, i. 311.

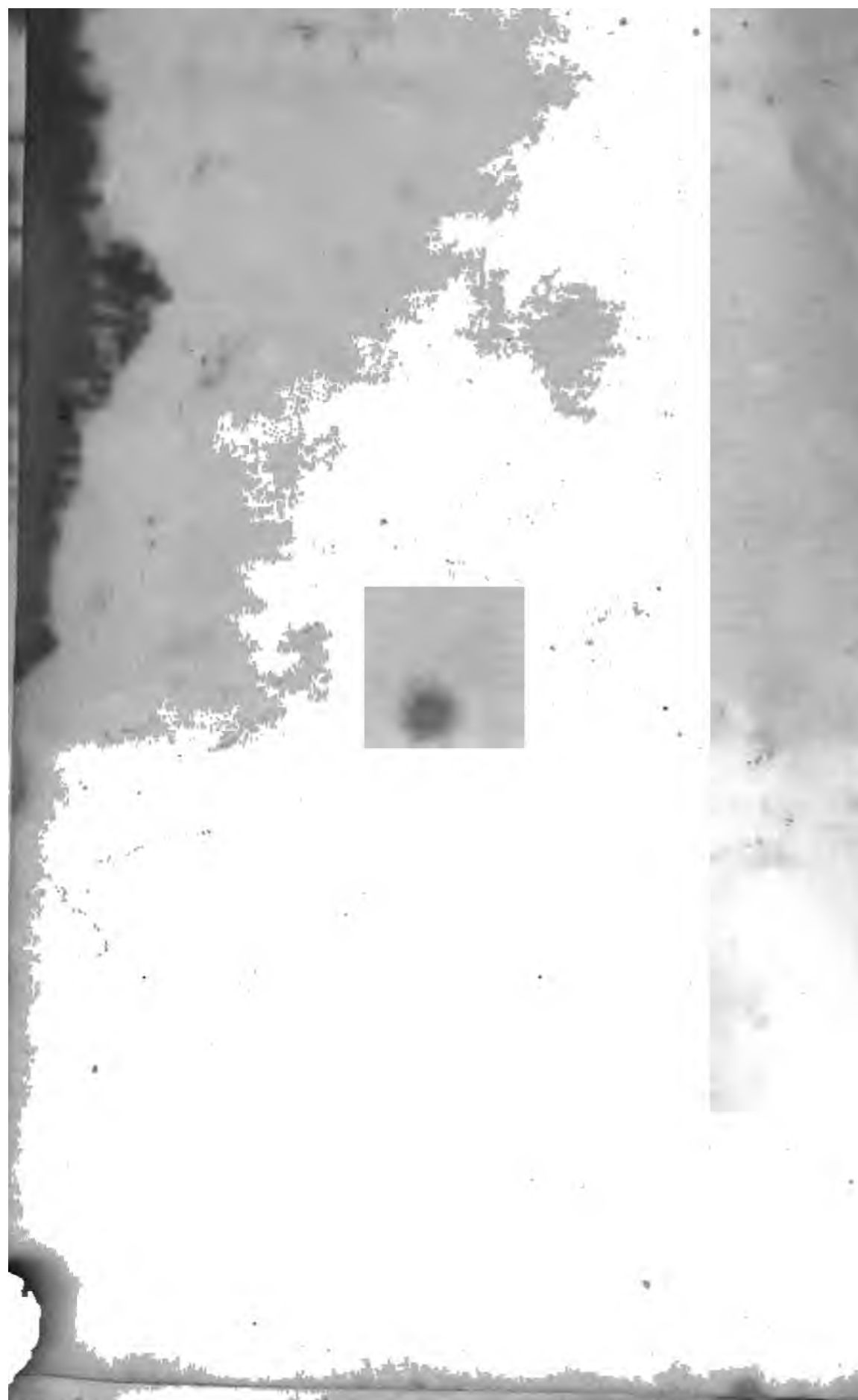
Zemni, or blind rat, its description, i. 451 n.; see Spalax.

Zeus, or Doree, a prickly-finned fish, ii. 286.

Zibet, a variety of the civet, its distinguishing marks, i. 421.

Zoophytes, meaning of the term, ii. 487; what kind of life they have, 487, 488; their proper rank, 487; how distinguished from plants, 488; distinctions of the class, *ib.*; classification, Int. xxxviii.; difference of the fossil and recent species, i. 78 n.; form islands, 104 n.

Zorille, a variety of the weasel kind, i. 420.



1

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